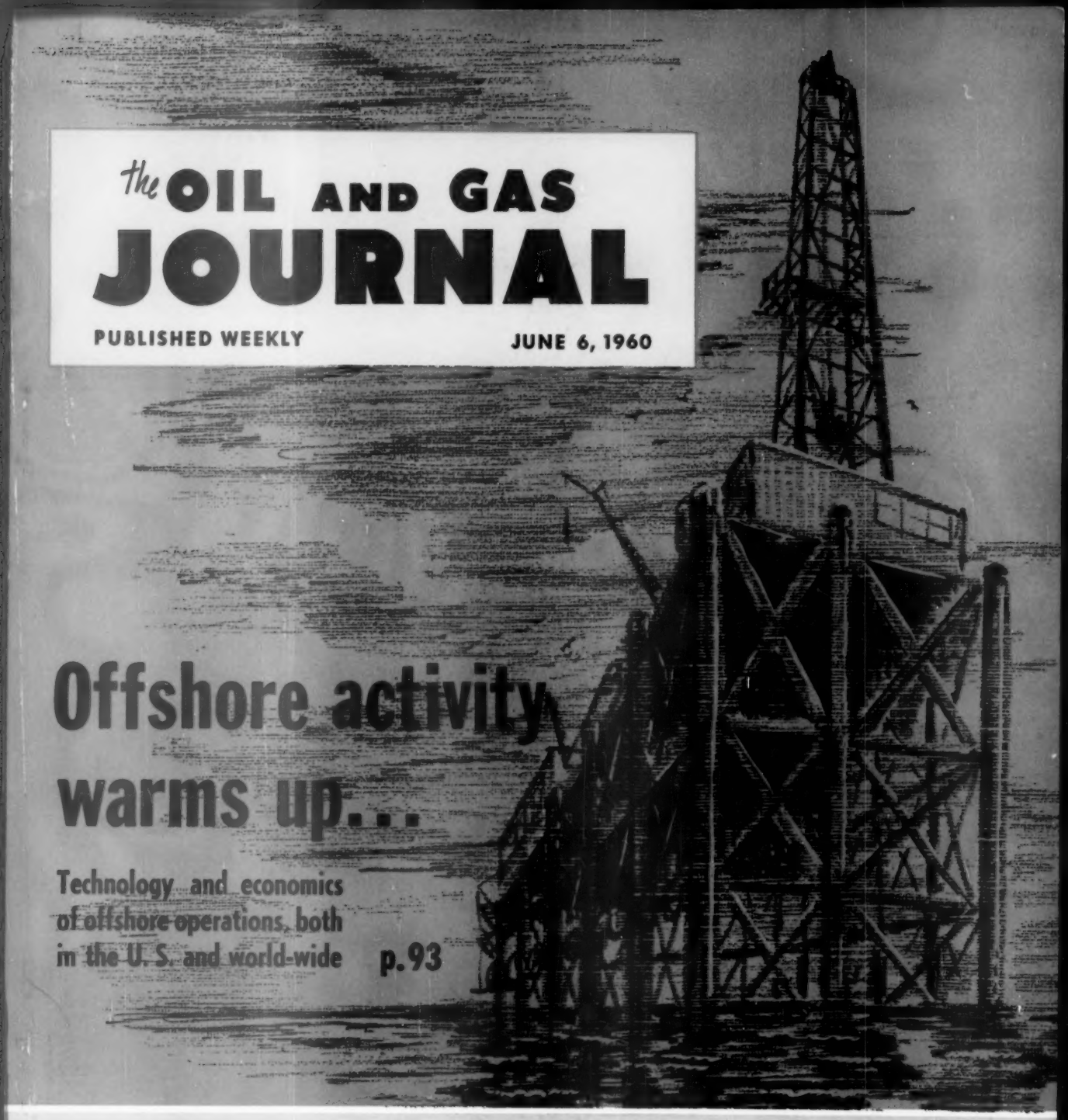
the OIL AND GAS JOURNAL

PUBLISHED WEEKLY JUNE 6, 1960



Offshore activity warms up...

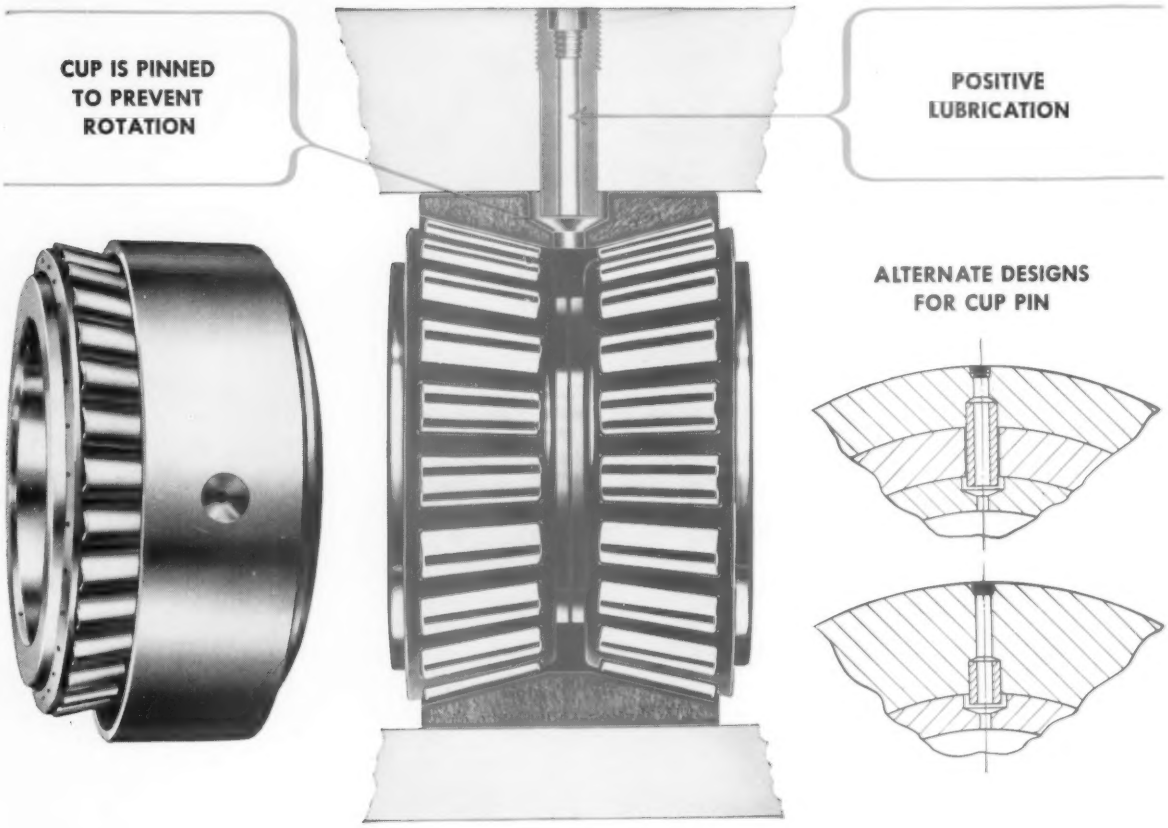
Technology and economics of offshore operations, both in the U. S. and world-wide p. 93

Tidelands ruling leaves some critical questions unanswered

p. 69

Phillips plugs leaks, cuts transportation costs $750,000

p. 76



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Now you can get a new Timken® bearing—first of its kind developed for floating bearing positions—that answers the problem of excessive wear from creeping and pounding in gear drives, spindles and many other applications. It's a pin-cup, double-row tapered roller bearing. Manufacturers can assemble and adjust gear drives, then merely set the pin. Result is a bearing that floats endwise but cannot turn in the housing. It greatly reduces wear, provides for continuous, positive lubrication. This new Timken bearing gives you all these advantages for those applications where there is an inherent tendency for the cup to creep or turn in the housing.

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This new pin-cup bearing results from Timken bearing research and development. Research to make machines perform better at lower cost. And the combined, new $2½ million engineering and research facilities of the Timken Company, unique in the industry, make progress like this possible. Make it yours when you use Timken bearings in the machines you build or buy. Another reason why "Timken" is your No. 1 bearing value.

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OIL AND GAS JOURNAL
Vol. 58, No. 23

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WORLD-WIDE OFFSHORE REPORT

Continental Shelves Are Busy in Both Hemispheres **93**

By Paul Swatn

The Persian Gulf, the Sea of Japan, and the Gulf of Paria are the offshore hot spots outside the United States. And Shell is making active preparations to spud a well in the North Sea. A half-dozen more continental-shelf areas are being eyed by drillers.

Activity Is Increasing in the Gulf of Mexico **99**

By Ed McGhee

The economic climate is pleasanter than it has been for 3 years. Companies have recently bid record sums for unproved offshore acreage, drilled new wells this year at a near-record pace, and increased demand for offshore rigs enough to raise rental prices.

Great Lakes Search Focuses on Lake Erie **102**

By Bryson C. Donnan

There were 48 field wells completed and 25 wildcats drilled on Lake Erie last year. The coming season will be the busiest yet, with estimates of a 15% increase in activity.

Offshore Figures Tell Costly Story **105**

By Ed McGhee

CATC figures show that the company pays 2 to 5 times more for its wells offshore than for similar wells onshore. And these wells are 3 to 5 times as costly to produce as dry-land wells.

High-Accuracy Control Systems for Submarine Pipelines **108**

By R. J. Brown

Control systems using the tellurometer for offshore operations fulfill high-accuracy requirements for locating submarine lines during installation.

Underwater Completions May Improve Offshore Economics **116**

By D. H. Stormont

Studies made by a West Coast contractor show floating barges cheaper than platforms for developing offshore fields.

Technology—Operation

A Fresh Look at the Isomerate Process **120**

By Hollis O. Folkins and Harvey Hennig

Since it was first announced in 1956, Pure Oil's process has undergone extensive development work. Here are some of the latest details.

Chemical Application Helps Unload Oil, Gas Wells **124**

By K. J. Lissant and G. J. Samuelson

Two new advancements now allow for the stimulation of production from oil and gas wells that have been killed by accumulation of water, oil, or well-treating fluid. One generates a large volume of gas at the bottom of the well and the other uses a surfactant to induce foaming.

Book Reviews **127**

New book develops concepts of physical properties of petroleum reservoirs; others.

The Foreman's Page: More on Fluid Flow **128**

Memo to Management:

There's No Magic Formula for Spotting Creativity **129**

By John M. Crawford

But there are ways to nurture the creative talent that you have and ways of providing a favorable climate for creative effort.

Ohio's Grasshopper Pump Saves Time, Trouble, Money **134**

By W. B. Bleakley

Mechanical linkage on dual pumpers stops interference between rods and hangers. Modification can be made for about $150, which will pay out quickly in reduced maintenance costs.

Questions on Technology **136**

Repairing Pipeline Breaks at a River Crossing **139**

Transferring Liquefied Gases by Pipeline **141**

The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
June 6, 1960

Watch for the offshore issue to land in Congress:

A drive in Congress is almost certain attempting to give Louisiana, Mississippi, and Alabama a three-league submerged land boundary.

This would in effect overrule Supreme Court's limit of 3 miles for those states (p. 69)*.

But such legislation will face heavy odds.

Justice Department probably won't ask for rehearing of the high court's ruling giving Texas and Florida title to submerged lands three leagues seaward in the Gulf of Mexico.

This means the tidelands battle is over for those two.

Other Washington tips:

Interior is pressing hard for amendments to the Helium Act. Secretary Fred Seaton has written to members of Senate, where legislation is now being considered, urging action to insure construction of helium plants.

Major political parties are now drafting campaign platforms for consideration at the conventions. As might be expected, coal officials are pressing them for a stand on a fuel policy study.

FPC action on the Phillips case before long is a growing possibility, despite earlier delays caused by death of Commissioner John Hussey and the congressional probe of FPC.

Legislation to authorize tax deductions for certain type of lobbying expenditures faces an unhill fight. This legislation is particularly important to trade associations which fear that contributions from their members may be endangered.

▼ ▼ ▼

Slugs of alcohol may be used to test future life of water-flooded wells.

South Penn Oil Co. is planning the small-scale pilot test in Bradford field. The test is expected to be a flop financially. But officials feel it may open up staggering reserves of oil if it shows that tertiary operations can produce oil still left in the ground.

---

*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

Hint of some changes in price of California crude comes from George Getty, Tidewater president.

He told recent press conference he thinks price of state's high-gravity crude (from 25-27°) should be shaved 10 cents a barrel and price of heavy crude jumped to 10 cents.

The reason: High-gravity crude is losing its attractiveness.

Central Kansas producers have found market for a big part of their crude shut in after Derby cut price 20 cents a barrel (p. 72).

Interesting court fight is shaping up in case after Kansas Corporation Commission refused Derby's request for a rehearing.

Esso Argentina is preparing to receive bids on a 388-mile, 14-in. crude line from Challaco in the Neuquen producing area to the port of Bahia Blanca.

American and Italian contractors are interested in the $33-million project which will be built for YPF, the government company.

▼ ▼ ▼

Wildcat is planned almost in heart of downtown Los Angeles by California Standard.

Site is being prepared for a 10,500-ft. test to be drilled near 7th Street and Alameda Avenue, which is just a bit over a mile from City Hall. The well is 1.5 miles southwest of Boyle Heights field, discovered by Richfield in 1955. Richfield has three wells producing 66 bbl. daily in field.

Look for another fight over ownership of minerals under Texas highways.

Trouble first arose last year over decision of Texas Highway Commission to lease the minerals under 26,000 acres of state highways crossing oil and gas fields. Legislature stopped this until it could investigate the commission's right to lease and set a policy.

Problem has grown now because county roads and streets have gotten into the act. An even tougher question: Who owns the minerals under 1,200,000 acres of such roads?

This hot chestnut was tossed into the lap of the Texas attorney general by the Kleberg County attorney.

Is Georgia really eager for oil production? That's what Hunt Oil and Pure Oil are asking.

Some 6 weeks have passed since the firms responded to a state invitation to bid for leases on Georgia's offshore lands. And the state mineral leasing commission still has given no indication as to when—or if—it will act to decide who gets what.

Alaska's Copper River basin is a possible gas area.
Geological reports indicate surface gas seeps. Gas encountered in a water well drilled to 500 ft. caught fire twice. The area has mud volcanoes with seeping gas.

▼ ▼ ▼

Russian gasoline will be imported by some Canadian distributors.

Plans call for importing 60 million Imperial gallons of gasoline initially at a price to the distributors of 15 cents per gallon. That would equal about 12.5 cents per U.S. gal.

The gasoline plans are being made after earlier efforts of Russian oil industry to sell crude to Canadian refiners failed. Soviets now are bypassing the refiners (p. 80).

Much needed improvements in knock-testing of motor fuel have moved a step nearer realization. An intensive development program for new lab methods is expected this year. That's the word following a special report on octanes made to the API Automotive Research Committee (p. 86).

Merchandise available to oil credit-card customers seems to be continually expanding.

Phillips Petroleum is now allowing its dealers to sell and install Frigiking auto air conditioners in customers' cars and charge the cost to their credit cards. Easy credit terms of up to 18 months to pay are allowed.

Idea is to give the dealer another profit line and serve the customer with items he needs.

A preassembled station that can open for business the day it is delivered to a completed site has been developed by Vickers Petroleum Co.

The 35-ft. by 10-ft. building can be delivered within a 400-mile radius of Wichita for less than $6,000.

▼ ▼ ▼

Latest sampling of geologists' opinion on professional registration shows the rockhounds still are deeply divided.

Returns from nearly 1,000 Texas-New Mexico members of the big Southwestern Federation of Geological Societies shows 425 favor registration, 455 oppose, and 109 are undecided.

Median annual salaries for scientists in U. S. during 1956-58 have been released by National Science Foundation.

Highest median salaries—above $10,000—were paid to persons in chemical engineering and medical sciences. The lowest—just over $6,000—went to agricultural employees.

Scientists in management or administration had the highest median salary ($11,000) while those in the teaching profession had the lowest ($6,500).

Market Memo

June 6, 1960

Supply and demand are on a honeymoon, and Memorial Day weekend driving firmed gasoline prices.

Demand for gasoline means the desire to buy it coupled with the power to buy it. A good demand means better prices.

Good weather brought out the desire to go places and gave farmers the opportunity to "farm."

A late spring had demand lower than expected with refinery runs higher than needed and gasoline stocks in excess of anticipated needs.

Midwest gasoline price postings are up, and that is good news from an area where such a move was most needed.

Mississippi River spot prices are firmer.

Gulf Coast spot prices are steadier and firming in the market place.

Honeymoons in June-July generally portend happy times until Christmas, and that is welcome news for product prices as June starts.

Group three 91 RON gasoline for northern shipment is up one-half cent per gallon effective May 31 and currently is posted at 11 cents, with no discounting in evidence. Middle distillates are inactive. Sellers are not interested in the "bargain basement" price ideas indicated by would-be buyers. Spot No. 2 is offered at one-quarter cent off posted price of 7.75 cents.

In Chicago, posted prices on all grades of gasoline from 89 through 99 RON are up one-half cent. New postings of 11.5 cents for 91 RON and 13.75 for 98 are firm. Discounts of one-quarter cent are offered on middle distillates with no takers.

Improvement in gasoline prices in Chicago and out of Group 3 for northern shipment has reacted promptly on the Mississippi River offerings, where price quotations are firmer by three-eighths to one-half cent per gallon. Several mid-river sources are "sold up" through June on gasoline.

Gulf Coast spot prices on gasoline are firming seasonally with discounts of one-quarter cent per gallon or more, depending on octane. No. 2 spot price is tight at one-eighth off posted 8 cents per gallon. No. 6 price also is firm at $2.10-2.45. Steel demand for low sulfur is easing, yet overall demand for No. 6 holds prices firm at postings.

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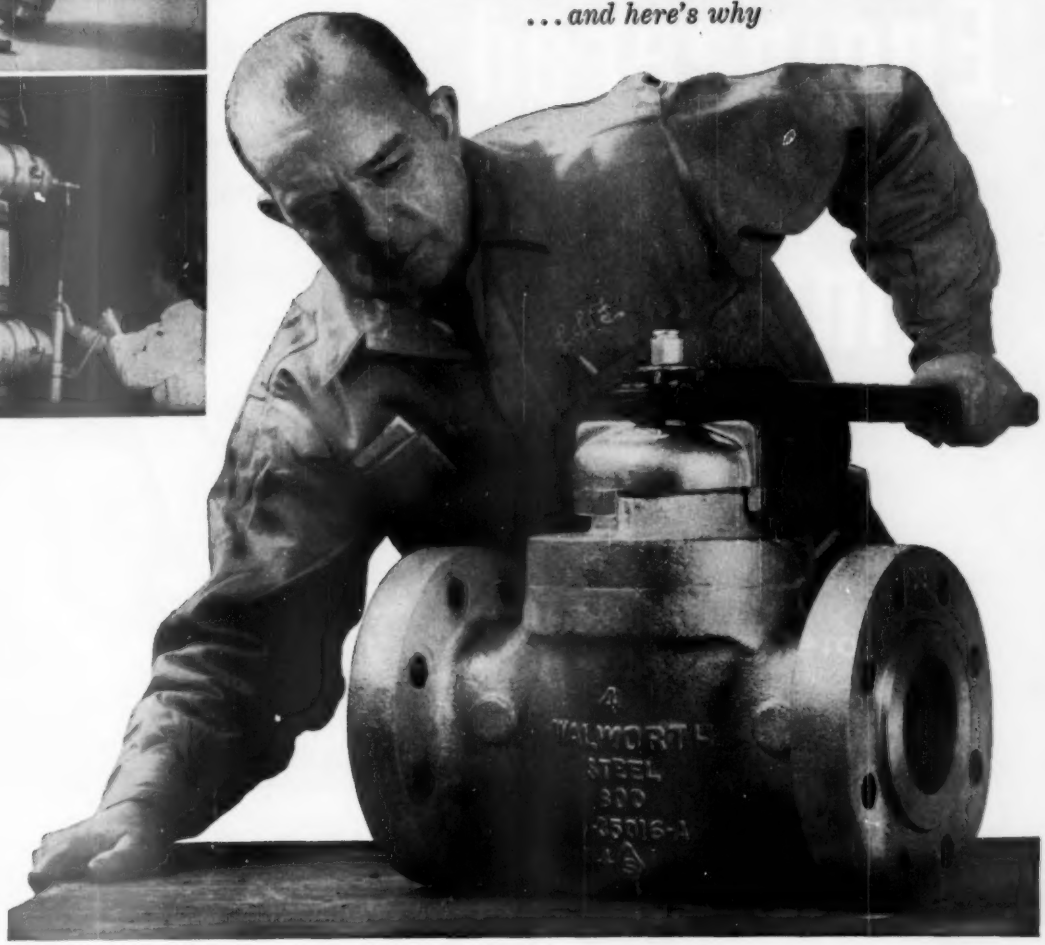

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B.F.Goodrich Chemical *raw materials*

check valve with

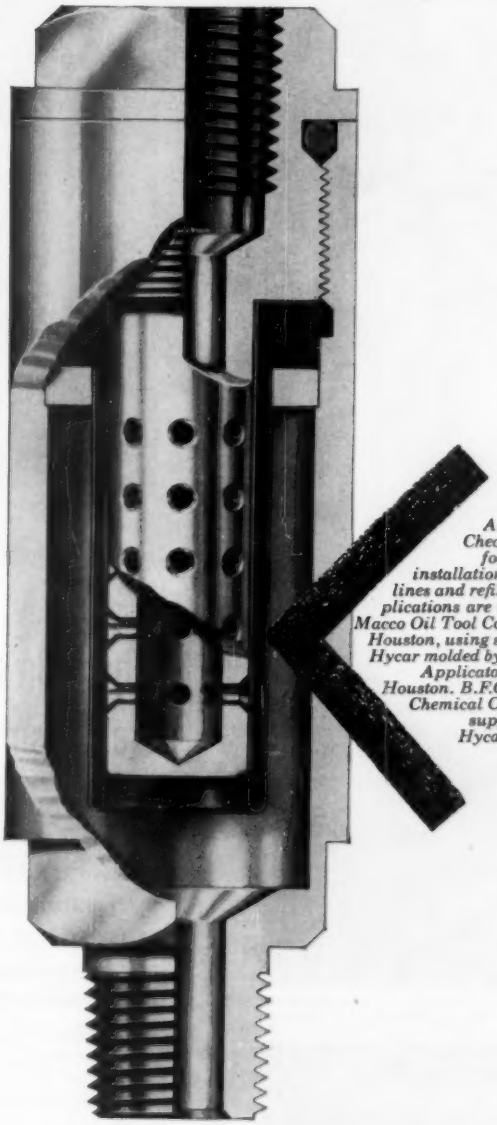
sleeve of Hycar

protects multiple-zone completion

This auxiliary check valve is normally used in series with a regular check in multiple completion oil wells. During long waiting periods, mud cake can jam the balls of gravity, magnetic, or velocity checks. This check valve provides positive prevention of backflow with the help of a squeeze-proof resilient sleeve made of Hycar nitrile rubber.

The Hycar sleeve conforms to odd-shape debris and mud cake, absorbing the force of flow of abrasive, sand-laden fluids. It remains effective as a sealing element under the most adverse conditions for long periods. Its manufacturer says Hycar performs under these tough conditions better than any material tested.

Here's another example of why it pays to specify Hycar rubber for your tough applications. Hycar resists abrasion, and stands up under corrosive influences, retaining its resilience far better than ordinary rubber. For more information, write Dept. FH-5, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



Macco Auxiliary Check Valves for gas lift installations, pipelines and refining applications are made by Macco Oil Tool Company, Houston, using sleeves of Hycar molded by Rubber Applicators, Inc., Houston. B.F.Goodrich Chemical Company supplies the Hycar nitrile rubber.

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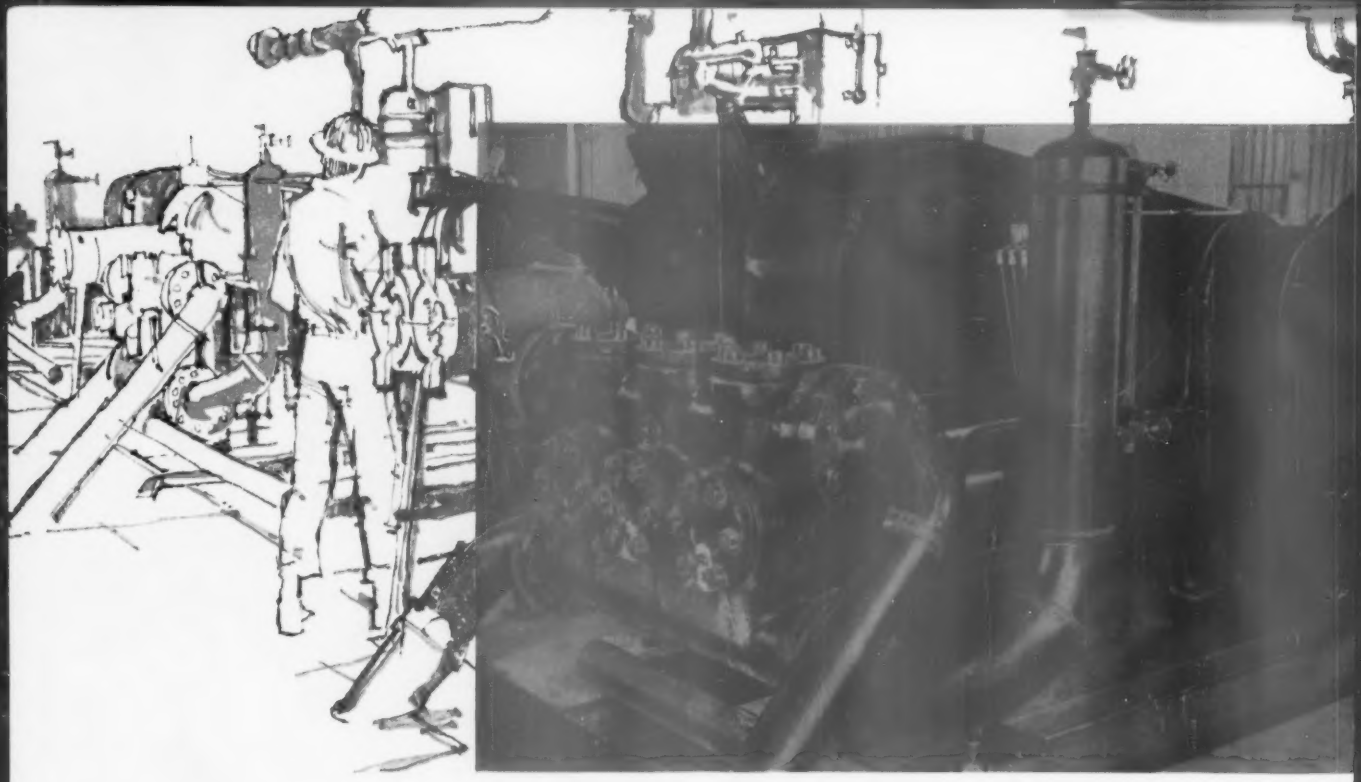

4-inch stroke triplex plunger pumps in waterflood service near Clay City, Illinois.

6-inch stroke triplex plunger pumps in a waterflood installation in the bayou country of Louisiana.

8-inch stroke quintuplex plunger pumps on the world's largest waterflood at Long Beach, California.

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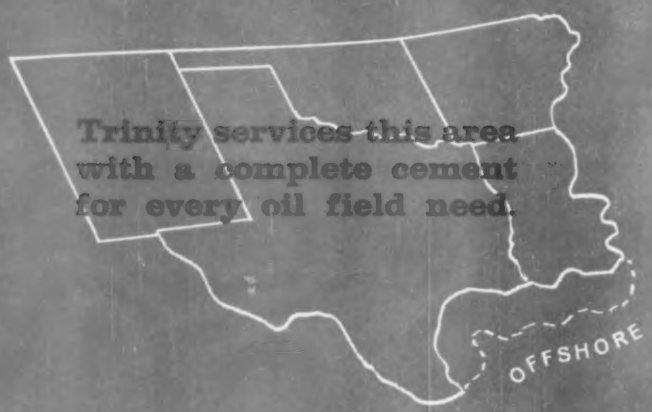

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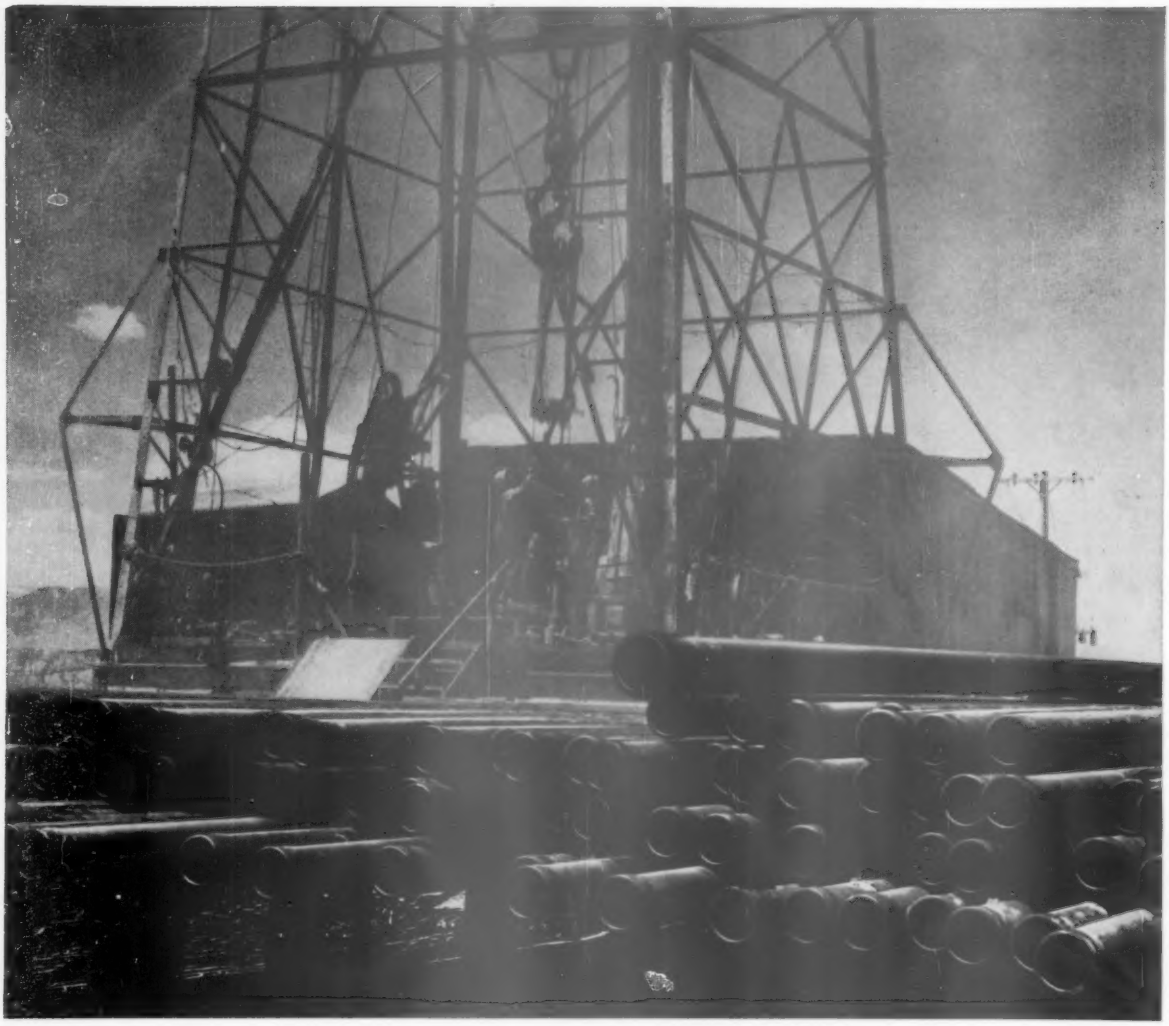

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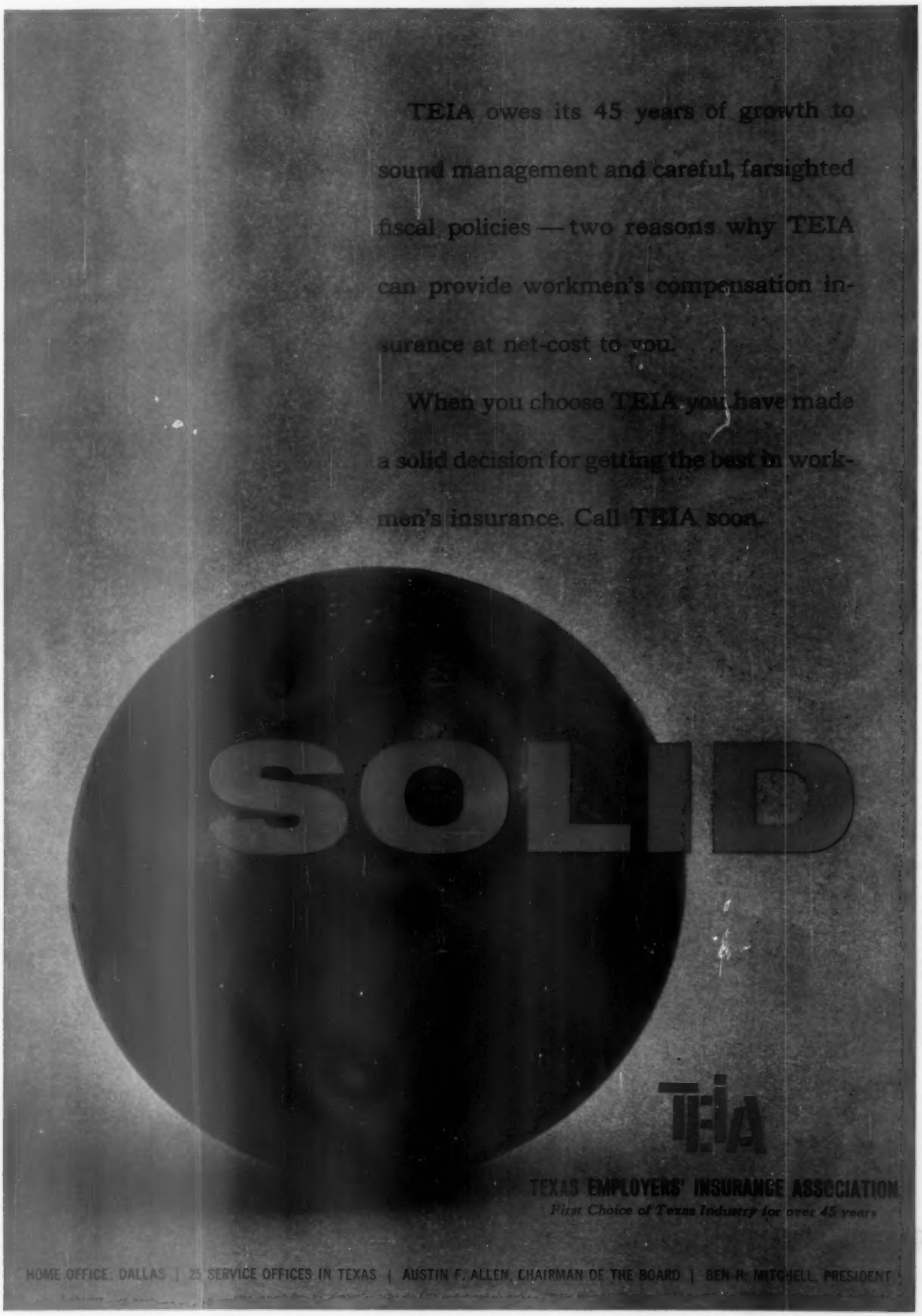
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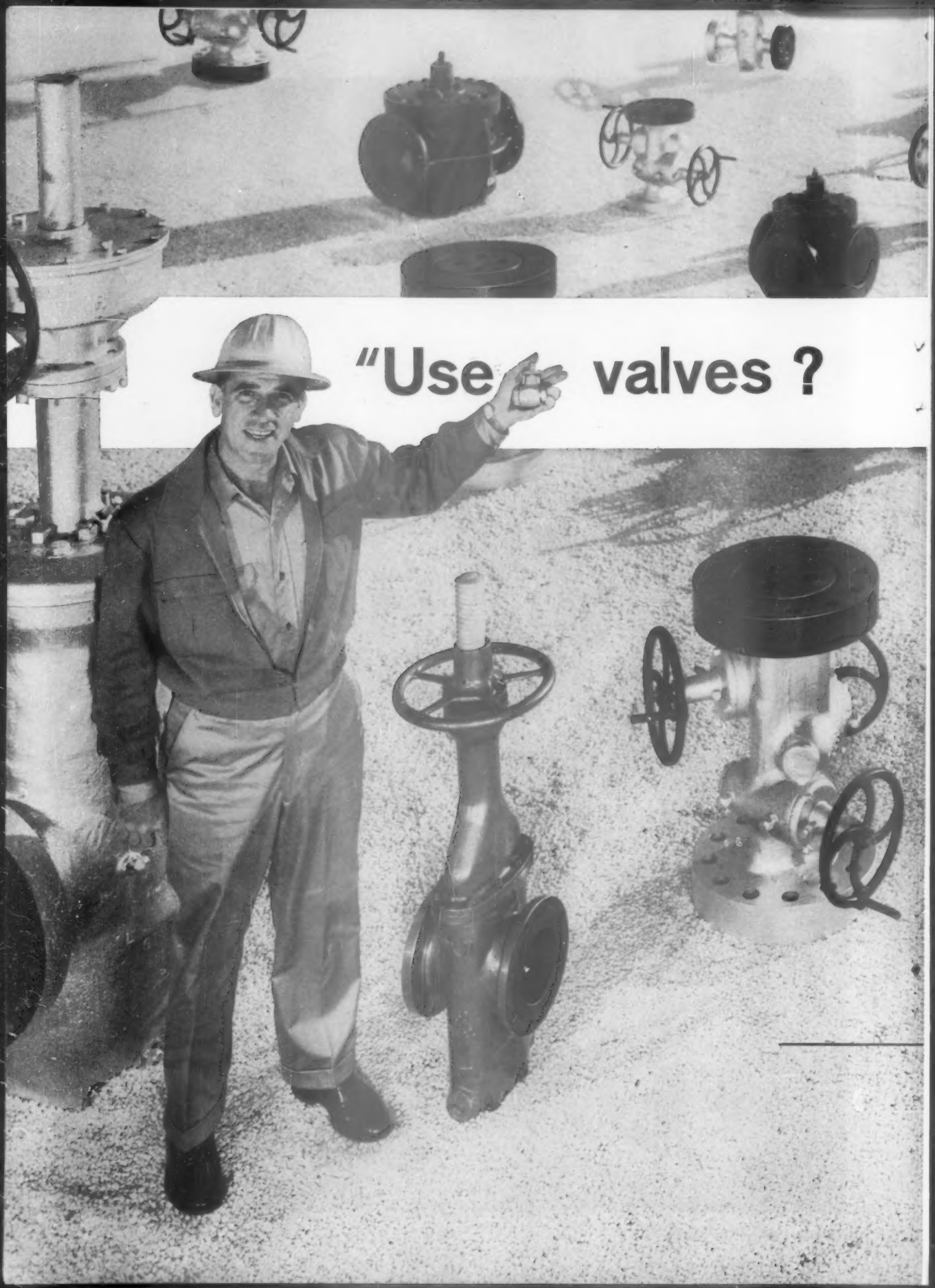
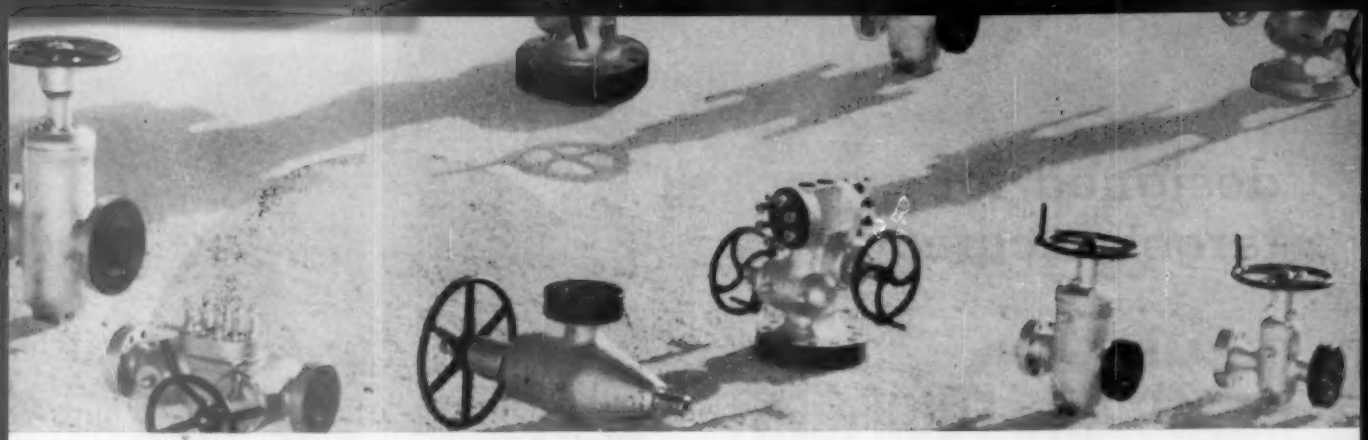

"Use valves ?



Use the best !"

W-K-M and ACF Valves for the Petroleum Industry

Whatever your requirement, there's an industry-proved W-K-M or ACF valve that will handle the job superbly — and with long-range economy.

Since 1932, W-K-M Oilfield Valves by the tens of thousands have harnessed the complete range of wellhead pressures — up to 13,100 psi, the world's highest. ACF Plug and Ball Valves have been industry leaders in gathering and storage systems, oil refining and gas processing. And today there are more W-K-M Pipeline Valves in mainline service than any other valve.

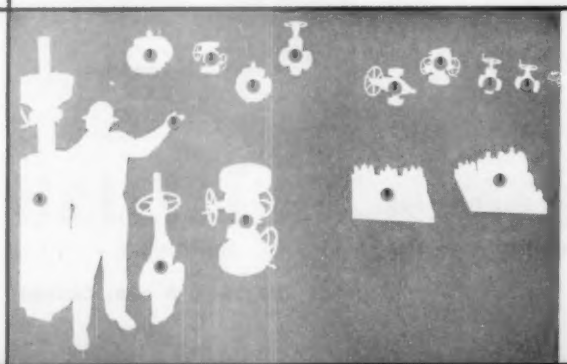
Next time specify the *best* valves made — W-K-M and ACF!

Available from leading supply stores and wellhead manufacturers.

PRODUCTS OF W-K-M's
Creative Engineering

W-K-M

DIVISION OF ACF INDUSTRIES
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS



For complete information on valves by W-K-M, write for the following catalogs:

CATALOG 200: ① Standard API Gate Valves ② Balanced Stem Gate Valves ③ Multiple Completion Gate Valves ④ Cross Type Gate Valves ⑤ Regular Port Gate Valves. **CATALOG 300:** ⑥ Standard ASA Gate Valves. **CATALOG 400:** ⑦ ACF Lubricated Plug Valves. **CATALOG 1000:** ⑧ ACF Non-lubricated Ball Valves. **CATALOG 1200:** ⑨ Pressure Sealing Gate Valves.

5923

designed for target accuracy...

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First in the field... First in performance... this is the record Halliburton has achieved in the development and pioneering of Measuring Devices. Halliburton has maintained constant leadership in advancing improved Measuring Equipment through continuous research, keeping pace with current demands.

Many different types and varieties of manually operated or power-driven measuring assemblies can be selected for your specific requirements, with the assurance of accuracy, simplicity and effectiveness.

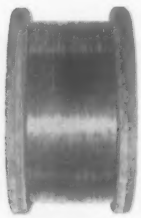
Your local Halliburton Representative will gladly assist in analyzing your needs and help to select the units best suited for your particular operation... call him today.

HALLIBURTON MEASURING EQUIPMENT...
FOR WELL CALCULATED MEASUREMENTS

MEASURING LINES

Halliburton has more years experience with rounded steel measuring lines than all other organizations of its kind. Changing field requirements and modern operations demand even more rigid specifications, permitting only those lines that do the best job to be offered. Your requirements determine which is most suitable...

REGULAR LINE

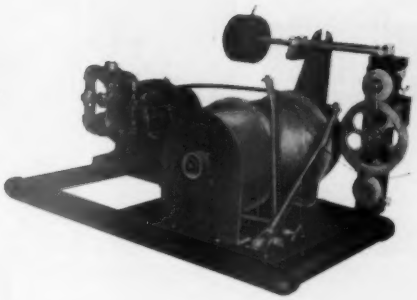


GALVANIZED LINE

* **Regular, Bright and Improved Steel—for economical use in wells under normal condition.**

* **Stainless Steel—designed for longer life when attacked by sour crude oil or gas.**

* **Galvanized Steel, Zinc Impregnated—will not rust, check or peel under normal operating conditions.**

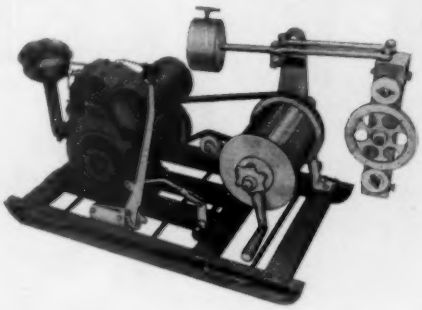


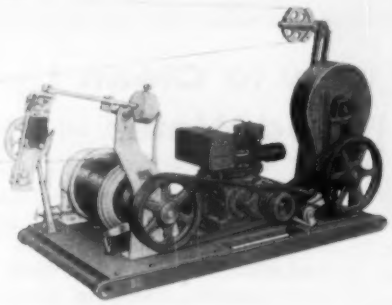
AIR-POWERED
MEASURING ASSEMBLY

Driven by compressed air power for greater safety and flexibility. Suited for well measurements requiring high starting torque, accurately controlled variable speed, or where possible safety hazards exist. Powered by radial 5-cylinder air motor, with built-in gear reduction. Capacity of Heavy Duty Reel Assembly is 18,000′ of .066″ dia. of measuring line.

REGULAR DUTY TYPE
POWER-DRIVEN

Designed for fast, efficient service on light measuring operations. Driven by single cylinder, air-cooled, 4.3 H.P. Briggs and Stratton gasoline engine with gear reduction power take-off. Reel is equipped with V-Belt Drive, V-Belt Idler Pulley Clutch Assembly and will carry 8000′ of .092″ dia. measuring line.



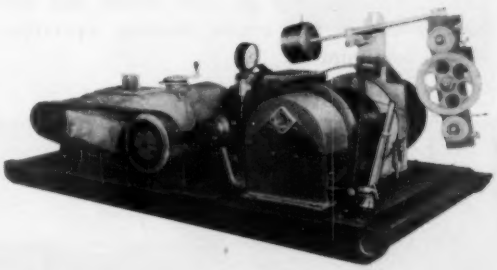


PARAFFIN CUTTING MACHINE
(and/or Power Driven Measuring Assembly)

This compact skid-mounted unit is powered by a gasoline engine. Its paraffin cutting function is actuated by an oscillating arm which imparts a stroke of 40 to 61 inches to the downhole cutting equipment. The machine can be operated simultaneously as a cutting device and measuring assembly, or independently as either. The unit is usually furnished with 10,000′ of .072″ dia. measuring line but the Heavy Duty Type Reel Assembly will accommodate up to 15,000′ of .072″ dia. measuring line.

EXTRA-HEAVY DUTY POWER-DRIVEN
(Three Speed Transmission)

Designed for accurate and efficient measuring in the deepest wells under the most rugged conditions. Used where dependable electric AC power is available. Measuring Assembly is powered by a 5 H.P., 220-440 volt, 3 phase, 60 cycle uni-closed variable speed electric motor. (Explosion proof motor is available at additional cost.) The unit features a mechanical transmission, with three speeds forward and one speed in reverse, for operations where unusually low line speeds or maximum line pull are required. This Extra Heavy Duty Reel Assembly will carry 14,000′ of .092″ dia. measuring line.



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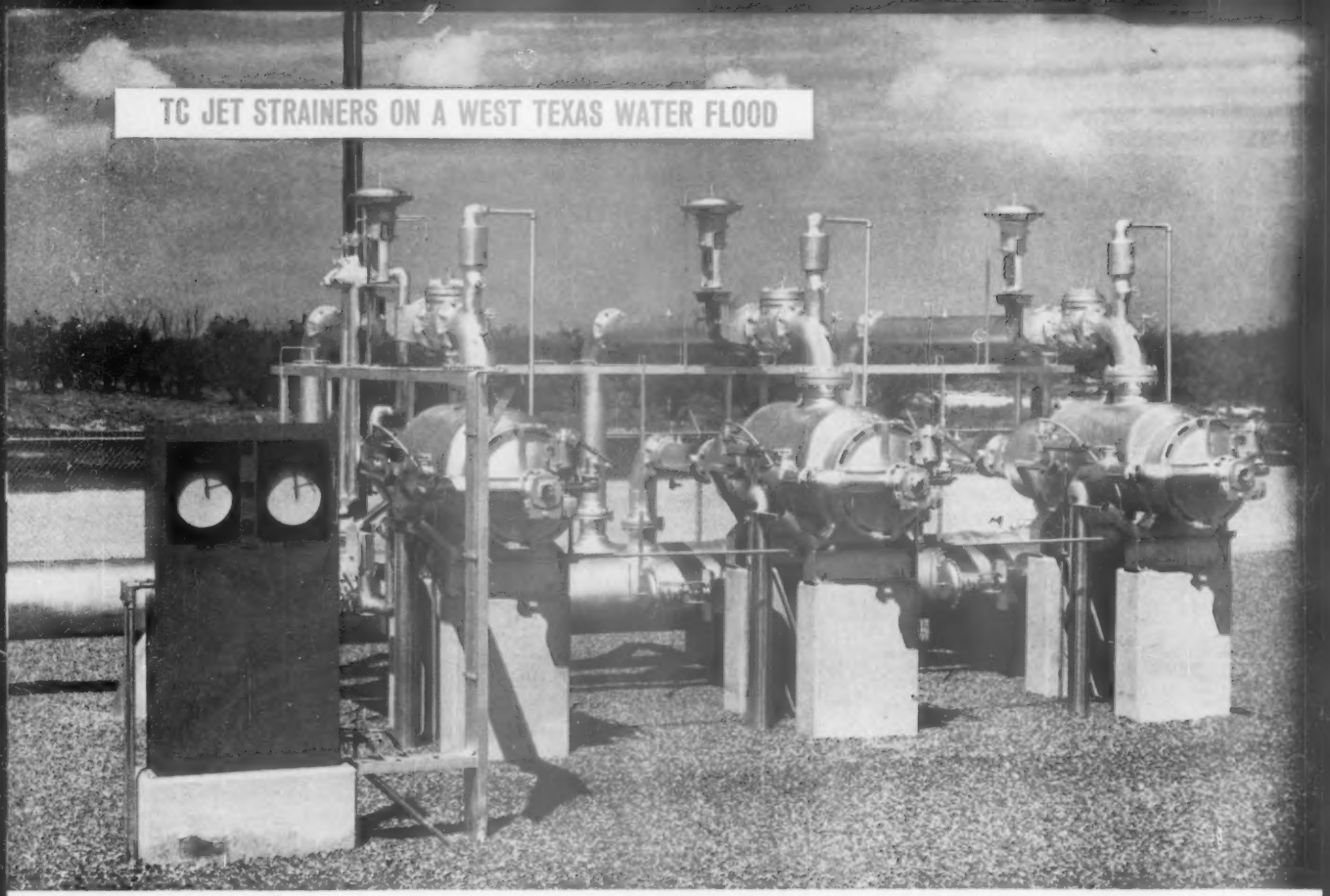
HALLIBURTON MEASURING EQUIPMENT

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA



The One Sure Way to Clean Up Injection Flood Water

There's a big difference in water filtration equipment. Here, for example, are three small, compact, T-C Self-Cleaning Jet Strainers with a huge capacity for handling injection flood water. But best of all, these strainers require little attention, even less maintenance expense. In fact, their operation is fully automatic. They clean themselves when the baskets become dirty. At a predetermined pressure-differential across the basket, rotating jets go into action and scour the baskets clean. The entire cleaning operation takes only a few minutes.

T-C Jet Strainers are available in 10H, 20H and 30H sizes. 100, 200, and 400 mesh screens are interchangeable, depending on the particle size of sand and solids to be removed from the water. Extremely fine filtration, down to sub-micron particle size—including algae and bacteria—can be obtained easily with the aid of a diatomaceous earth coating on the basket.

If you attach importance to the cleanliness of your flood water—and most operators do—you should know all about T-C Jet Strainers. A brochure will gladly be sent on request.

An over-all view of a water filtration installation near Odessa, Texas. The three Model 30-H, T-C Self-Cleaning Jet Strainers are shown in the close-up above and at far right in this picture.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS

In New Trucks or Old—
EATON INDUCTALLOY
AXLE SHAFTS

LAST 3 to 10 TIMES LONGER

Through billions of miles of heavy-duty service, Eaton Inductalloy Axle Shafts have proved their ability to deliver superior performance. Freedom from breakdown—more time on the road, less time in the shop—plus thousands of trouble-free miles added to axle life, mean lower over-all operating cost.

Eaton's exclusive method of dual hardening truck axle shafts produces an extremely hard case extending deep into the material structure, and enables Inductalloy Axle Shafts to handle more work and abuse without fatigue failure.

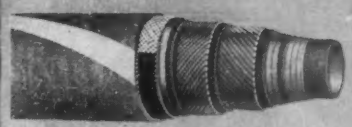
Eaton Inductalloy Axle Shafts are available not only in new axle equipment, but also as replacements for earlier models. Ask your truck dealer for complete information.

EATON INDUCTALLOY SHAFT

ORDINARY AXLE SHAFT

EATON

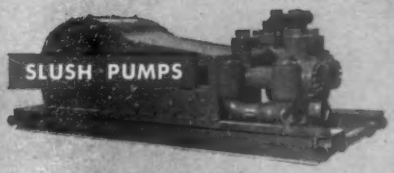
AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO



ROTARY AND
VIBRATOR HOSE

TRAVELING BLOCKS

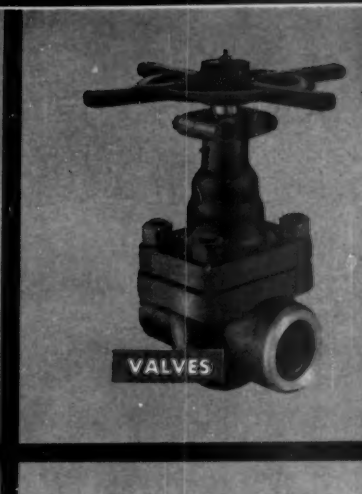
DESANDERS



SLUSH PUMPS

MID-CONTINENT SUPPLY CO.

SUPERMARKET



for the OIL INDUSTRY

Here you see just a few of the thousands of items of dependable, top quality drilling supplies and equipment available at Mid-Continent Supply Co. The "supermarket" for the oil industry has everything you need to make the job of drilling for oil—as well as the production and processing of oil—easier and more profitable. Operating out of these stores are skilled men, on call twenty-four hours a day, to render efficient service and offer technical assistance to the men in the field. From the Arctic to the Antarctic, the familiar Mid-Continent neon derrick is a symbol of sure service . . . sure supply . . . around the clock.

SM3-0

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THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

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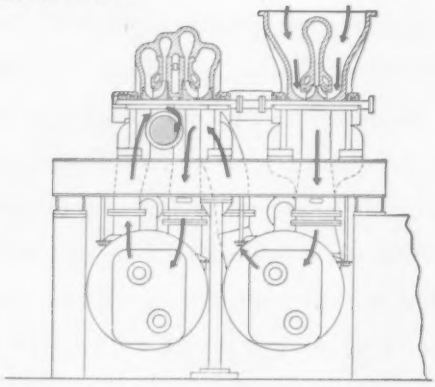
ANOTHER NEW DEVELOPMENT FROM INGERSOLL-RAND

Isometric drawing of new 60,000 cfm CVM compressor from discharge side—arranged for electric-motor drive through speed-increasing gear.

NEW intercooled centrifugal compressor provides 100-125 psi air at capacities to 60,000 cfm

Ingersoll-Rand's new intercooled CVM centrifugal compressor is designed to provide high efficiency and low operating cost for 100-125 psi air at capacities from 30,000 to 60,000 cubic feet per minute. Utilizing the service-proved design principles of the 5-stage CVM compressor, introduced by Ingersoll-Rand last year for capacities to 35,000 cfm, the new unit extends the advantages of isothermal compression to *twice* the capacity heretofore available.

This new, larger unit features a double-suction first-stage impeller in a separate casing, with single-suction second and third stages in a second casing. Both casings are horizontally split for easy access, and each casing has a separate shaft. The use of separate casings and shafts permits most efficient aerodynamic design and enables both rotors to operate below first critical speed. Efficient water-cooled intercoolers suspended beneath the compressor remove heat of compression, approaching the ideal condition of isothermal operation and substantially reducing power requirements. Ask your Ingersoll-Rand engineer for complete information.



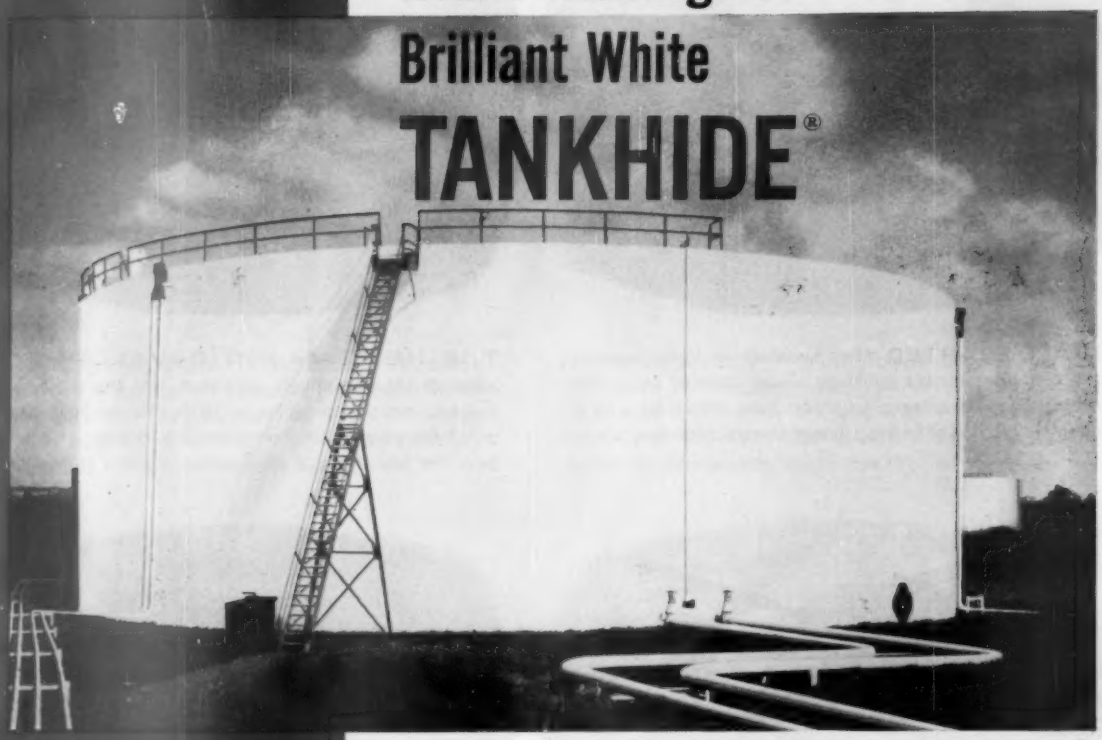
Side elevation with top half of casings cut away, showing air flow through compressor stages and intercoolers.

Ingersoll-Rand

139-A-12 11 Broadway, New York 4, N. Y.

THE WORLD'S MOST COMPREHENSIVE COMPRESSOR EXPERIENCE

More years of protection ...lower evaporation loss with Pittsburgh's Brilliant White TANKHIDE®



TANKHIDE'S special formula—using the finest titanium pigments and weather-resistant vehicles—makes it the toughest, most durable coating you can use on storage tanks. TANKHIDE will definitely:

1. **Reduce evaporation losses,** thanks to its unusually high solar heat reflectance.
2. **Give greater protection** against weather-wear and corrosion.
3. **Maintain its gleaming whiteness longer** because of its self-cleaning action.
4. **Cut tank maintenance costs.**

● **Let us prove TANKHIDE'S** very real advantages. Wire, write or phone Pittsburgh Plate Glass Company, Industrial Finishes, 1 Gateway Center, Pittsburgh 22, Pa.

Watch the Garry Moore Show—CBS-TV—Tuesday Evenings.

PPG

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PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

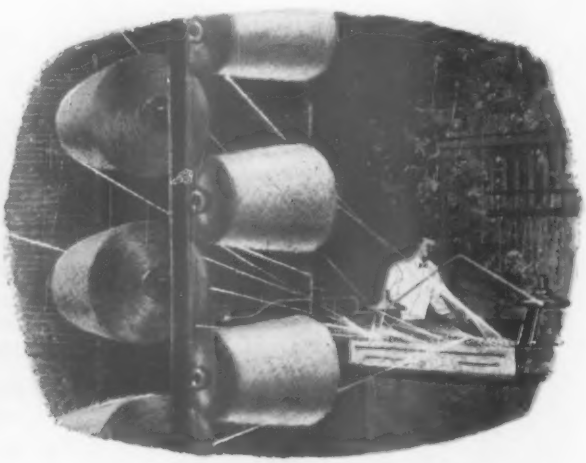
GOODYEAR

EVOLUTION OF

IT ALL STARTED when Leonardo da Vinci invented the belt drive for his polishing wheel. Spurred on by the drive's many advantages, engineers have striven for a more effective method of indirect power transmission ever since.

THE NEXT MAJOR DEVELOPMENT, although then seemingly unrelated, was the discovery of the vulcanization of rubber in 1839. Charles Goodyear not only fathered a multibillion-dollar industry, but also helped pave the way to much more efficient power transmission.

ANOTHER MAJOR BREAKTHROUGH came in 1941, when Goodyear introduced the first practical Steel Cable V-Belt for use on Army tanks. Here was the strongest, most efficient, most heat- and stretch-resistant belt ever built. A wartime success, steel cable is used in belts handling today's toughest industrial drives.

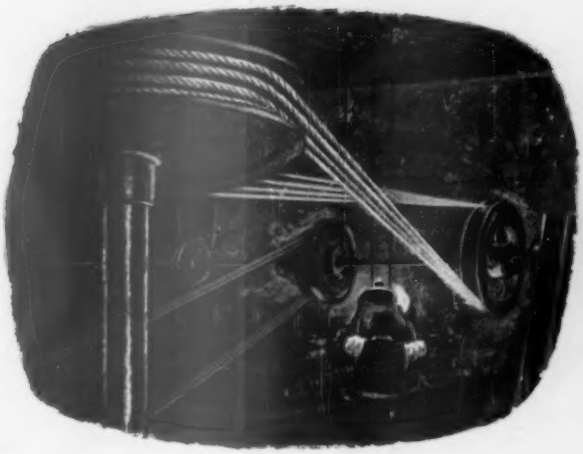


THEN CAME THE "MIRACLE" FIBERS and super-rated V-belts. Again Goodyear was in the fore with the HY-T V-Belt—a strong, shock-resistant belt that answered most multiple drive problems. But V-belt makers still sought a more effective way to overcome stretch and shrinkage.

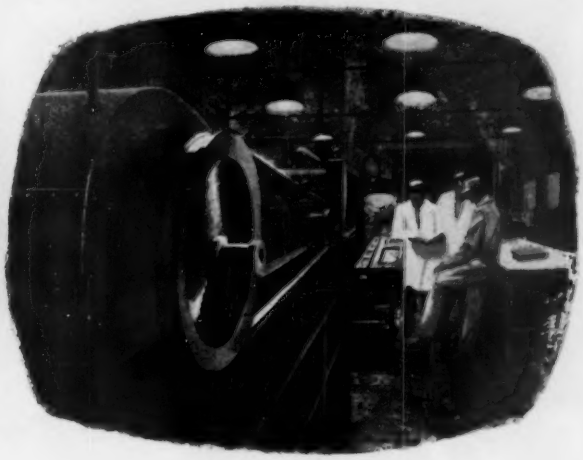
For maximum, trouble-free horsepower hours on any V-belt drive, insist on the top belt from the top beltmaker.

Lots of good things come from GOOD

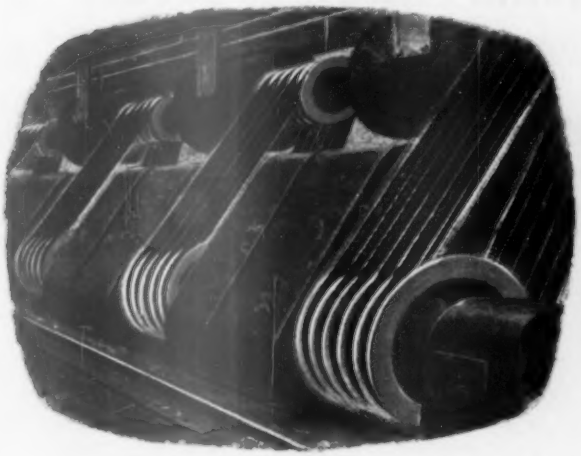
A REVOLUTION



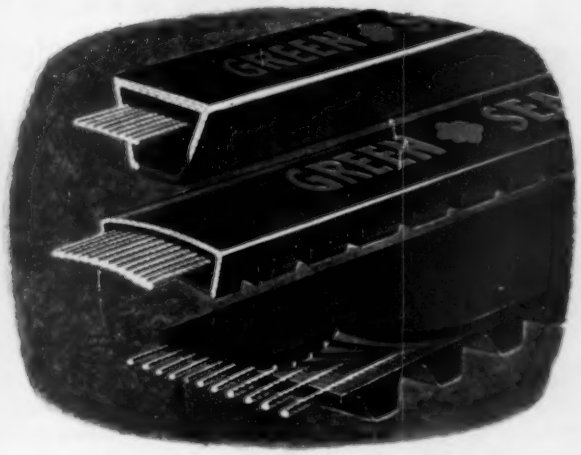
OVER A DECADE PASSED BEFORE a man named Combe introduced two new ideas in the transmission of power—teams of load-carriers and "wedge-in" action. His first multiple rope drive was not very efficient or durable, but started a whole new trend in development.



IT TOOK A LITTLE TIME before the first rubberized V-belts were introduced. Many of the earliest improvements were developed by Goodyear scientists. The greater efficiency of the V-belt soon placed it on many drives, despite shortcomings in length stability and strength.



GOODYEAR SOLVED THE PROBLEM with the 3-T Process to take surplus shrinkage and stretch out of synthetic cord. That development made possible multiple drive V-belts with true dimensional stability—Green Seal V-Belts by Goodyear that stayed matched on the drive or in storage.



A REVOLUTION IN POWER TRANSMISSION was launched by the complete line of V-belts with the Green Seal—Compass-V-Steel, HY-T, E-C Cord, and the compact new HY-T WEDGE. With P.D. (positive drive) and Variable Speed Belts, they combine to offer Goodyear belts of unsurpassed quality for every need.

See your Goodyear Distributor or write: Goodyear, Industrial Products Division, Lincoln 2, Nebraska, or Akron 16, Ohio.

YEAR

THE GREATEST NAME IN RUBBER

HY-T, Green Seal, E-C, Compass, P.D.-T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

"This GUIBERSON DRILLABLE PACKER

runs, sets and drills faster than any other permanent packer"

HERE'S WHY!

Guiberson Type A Drillable Packer..

REDUCES PREMATURE SETTING Casing drag and junk impact are transmitted through the mandrel shoulder directly to tubing string.

REQUIRES ONLY ONE-HALF TUBING TRIP to set and place in production . . sets on wire line, too.

REQUIRES LESS SETTING FORCE Spring loaded lower slips are held drag-free from the casing until packer is set . . teeth remain sharp.

REQUIRES LESS DRILLING TO REMOVE Top slips are first part drilled. After drilling through them, packer can be fished out, or ½ to ⅔ of packer can be drilled and rest pushed to bottom of hole.

USES A SUPERIOR, OIL FIELD PROVED PACKING ELEMENT . . made in Guiberson plant.

FORMS A POSITIVE SEAL Unique internal mandrel shoulder expands packing element. All weight and high pressures are transmitted to packing element for a positive seal.

Compare Guiberson Drillable Packers for single or multiple-zone production . . acidizing . . pressuring operations . . water-flooding . . testing . . corrosion control . . many other completion jobs. Their speed and efficiency of setting and positive seal cut operating and replacement costs.

There's a Guiberson packer for every drillable packer application . . See your Guiberson man

TYPE A — With flapper valve and junk pusher

TYPE AN — No flapper valve.

TYPE AG — No flapper valve . . has guide body in place of junk pusher

TYPE AT — Has integral tail pipe connection . . no flapper valve

TYPE W — Small diameter . . wire line set only

TYPE AR — Small mandrel ID . . with flapper valve

TYPE ANR — Small mandrel ID . . no flapper valve

TYPE AGR — Small mandrel ID . . has guide body

TYPE A2R — Doubly restricted mandrel ID

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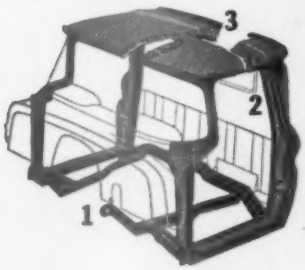
CHEVROLET

PROOF THAT CHEVY'S BIG NEW CABS ARE BUILT FOR A BETTER DAY'S WORK!

"THESE TRAILS WOULD SHAKE THE CAB OFF AN ORDINARY TRUCK... BUT NOT OUR CHEVY"

Few trucks are subjected to the body-wracking beatings that are part of a day's work for this Chevrolet Series 60 pulpwood hauler, owned by J. E. Fox, North Carolina logging contractor. As Bobby Fox, a partner in the business points out, "Loaded full-up with pulpwood, we drive right over stumps and potholes you'd think would tear the truck to pieces. These trails would shake the cab off an ordinary truck, but not our Chevy. You can always replace chassis components, but when the cab goes, you have to buy a new truck. Chevies are built to hold together longer. That's why we buy 'em."

■ *No matter where* you haul, you'll profit by the new toughness that's built into Chevrolet's truck cabs for '60. You'll benefit from a cab that's constructed to stand up to slam-bang runs over rough terrain, a cab that stays in A-1 shape years longer. Here are some of the ways in which Chevy assures this tight, maintenance-minimizing performance: **1.** Extra reinforcement where it counts reduces vibration; provides a solid foundation for cab sheet metal. Tough new longitudinal sills reinforce the underbody. **2.** Extra-sturdy door openings—box-section pillars and sills assure *lasting* alignment. Doors stay weathertight with a minimum of maintenance. **3.** New double-walled roof panels are sturdier than ever. Husky box-section pillars provide the solid roof support that means greater safety and maximum cab strength. ■ And there's a world of comfort for you, too. A *wide* seat, for instance, with a comfortable foam cushion and springs that soften the ride yet give you extra support where it's needed. And there's more head, hip, shoulder and leg room for husky drivers . . . a horizon-wide windshield with 26% more glass area, a new see-at-a-glance instrument panel, new conveniently suspended pedals. ■ First chance you get, visit your Chevrolet dealer and drive one of these new Chevies. Feel how Torsion-Spring Ride takes the bounce out of bumps; learn for yourself why it will lengthen truck life and lower maintenance costs. Check up on Chevy's famous gas-saving 6-cylinder and V8 engines. Then you'll know, for sure, why you can expect thousands of extra miles out of a Chevy; why you can be sure of more work per day at least expense. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.



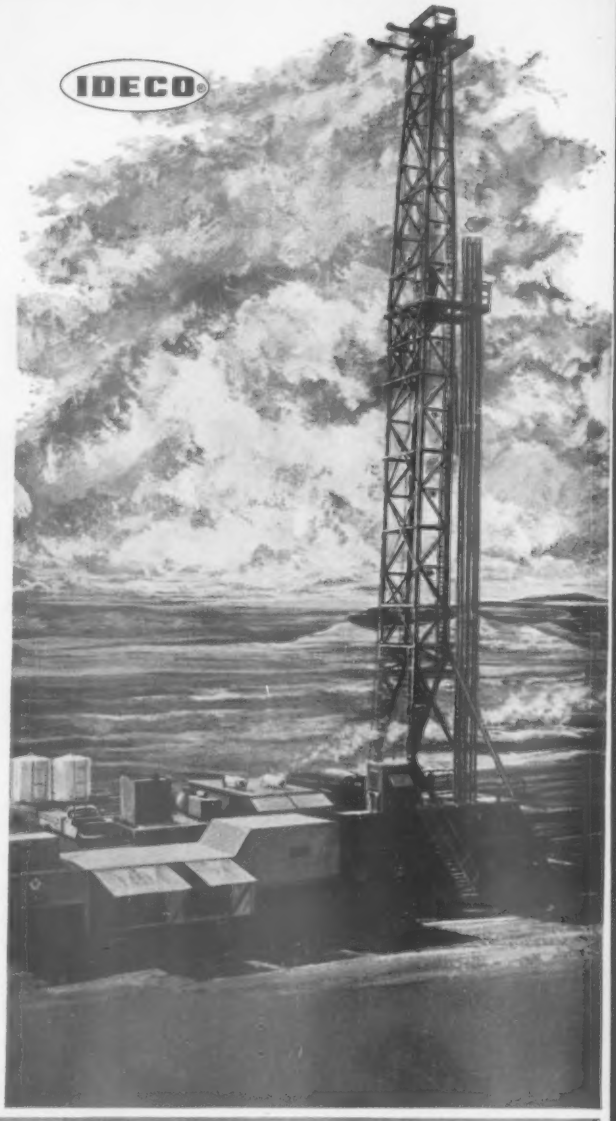
1960 CHEVROLET STURDI-BILT TRUCKS CHEVROLET

ANOTHER DRESSER BREAKTHROUGH

IDECO

Desert Rambler

AGILE GIANT *seeks oil oasis*



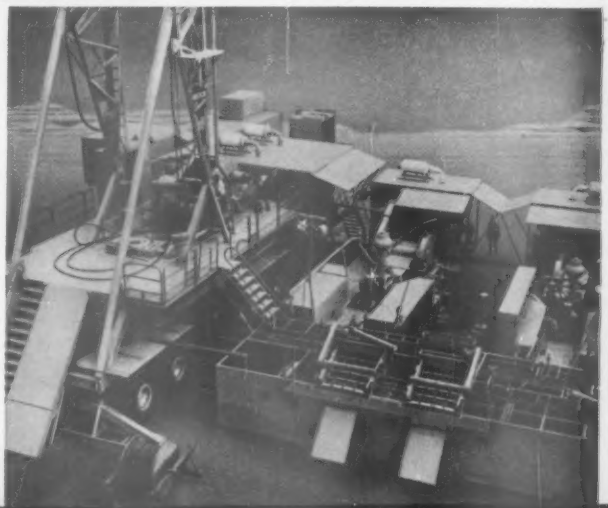
In the sands of the Libyan desert, where temperatures vary 100 degrees in a 24 hour period, the world's largest wheel mounted drilling rig searches for oil to help power the machines of the world. The five semi-trailers of this giant rig, manufactured by Ideco Division of Dresser Industries, are mounted on huge sand tires to allow rapid and easy movement over the soft and treacherous desert floor. Because of the remoteness of the area of drilling operation, the rig is equipped with a complete set of spare parts, and engines were chosen that could utilize crude oil as fuel.

The Desert Rambler towers 12 stories high and was built by Ideco for Camdrill International, Inc., a drilling firm operating extensively in North Africa. It is being used by the Oasis Oil Company, a wholly owned subsidiary of Ohio Oil, in a drilling program for Ohio and its associates, Amerada Petroleum and Continental Oil.

This highly mobile and efficient rig is another example of breakthroughs made by Ideco, manufacturers of the world's most complete line of oil and gas well drilling and servicing equipment. The company earlier introduced structural steel derricks to the oil industry and then put the drilling industry on wheels with its Rambler Rigs. Ideco equipment, including rigs, masts, mud pumps and accessories, is capable of handling work ranging from light servicing to the deepest drilling yet envisioned.

Dresser Industries, Inc., with its twelve operating units, has long been known as a major supplier for the petroleum industry. The Dresser companies, working individually or as a team, are given full support in

the parent company by a group of management specialists who encourage imagination and initiative in research and development. We will gladly send you full information on why Dresser equipment and technical services are recognized as standards of comparison the world over.



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PLANNED TODAY BY
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"Vigorous and Forward-Looking . . ."

"The hundred year history of the American oil industry has proved beyond all dispute that the greatest natural resource that any nation can have is the resourcefulness of free men competing with each other for ways to a better life.

"Oil hidden in the ground is worthless. It becomes useful, and therefore valuable, only when through courage, ingenuity and skill men discover it, bring it economically to the surface of the earth and turn it into products that people need. This is true of all so-called natural resources.

JOSEPH N. PEW, JR.
Chairman of the Board
of Directors
Sun Oil Company

"The key to progress, therefore, is freedom for men to continue to dream, plan, invent and experiment with new ideas, new tools and new methods in a never ceasing effort always to do their jobs better.

"As suppliers of the nation's basic energy source, oil men must continue in this traditionally progressive spirit. Never before has the need been greater than today for the utilization of better tools and advanced techniques in the recovery of oil and gas as a result of increasingly complex drilling and production problems.

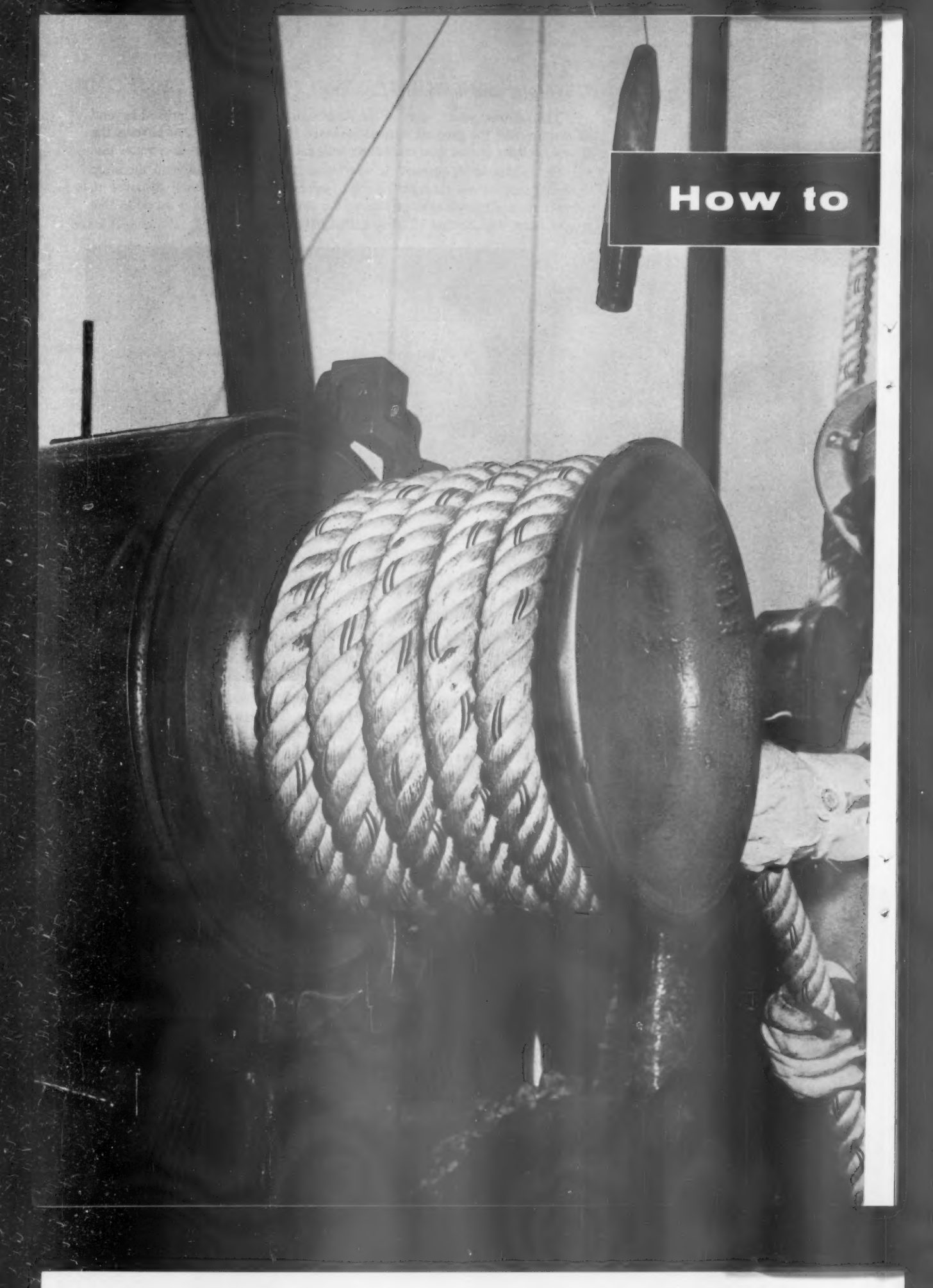
"In meeting this challenge, the technical men engaged in oil production join with the manufacturing, service and supply companies to provide the equipment, the technological advances, the methods and the services that are vital to the discovery of an oil field and its economically successful development. Vigorous and forward-looking, these companies exemplify the resourcefulness that has helped our industry contribute so greatly to higher standards of living for all mankind."

P.E.S.A.

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PROUD TO BE PART OF A PIONEERING INDUSTRY

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION


How to

Get Quality in Manila Rope

Convenience often determines where you buy manila rope, wire rope, rotary hose, chain, tools, paint, tongs, wiping rags. One of the more important duties of a supply store is to offer the best available in these expendable items.

J&L Manila Rope is a good example. When you rig up with J&L Manila, you get long life, safety, and easier handling.

J&L Manila Rope for oil country service is made of choice and strictly uniform grades of fiber. An exclusive time-tested basic Marine lubrication treatment is used to penetrate the fiber cells. This lubrication minimizes swelling, distortion, internal friction, heat and dry rot. The rope handles better, lasts longer.

See your J&L man for the rope with the two green marker yarns. For more information, ask him for your copy of the J&L Oil Field Manila Rope folder.

Jones & Laughlin

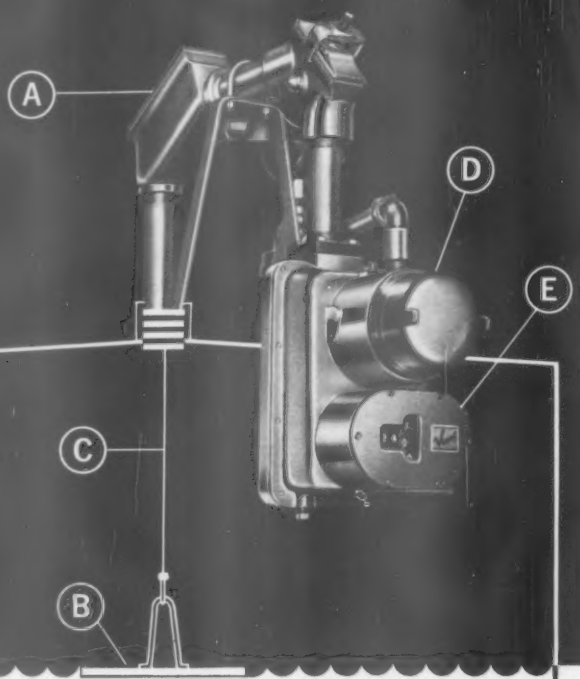
SUPPLY DIVISION – Tulsa

If it's sold by J&L....
It's the best available

80

VAREC DYNAMATIC

A POWER-DRIVEN LIQUID-LEVEL TANK GAUGE THAT COMBINES HIGH ACCURACY AND RELIABILITY WITH ECONOMY



The **DYNAMATIC** measuring device has a force measuring mechanism that consists of a torque tube, arm and contacts **(A)** and a displacer that can be any size, shape or material **(B)**. The displacer is suspended on the torque arm by a conventional perforated steel tape **(C)** and is driven in and out of the liquid by a reversible, two-phase servo motor **(D)**. Liquid level is indicated on a dial in the gauge head **(E)**.

The **DYNAMATIC*** 8400 Series is a power-driven tank gauge that operates continuously to keep a solid-plate displacer at the liquid level. It eliminates troublesome friction problems associated with floats, counterweights and spring balances, and provides a 1/16" tank gauging accuracy over a working range of 60 feet.

Reliability is insured by the simple force-balance system and the use of a solid-plate displacer that cannot leak, be ruptured by pressure, or 'hung-up' to cause tape entanglement. The system is unaffected by change of tank product, and needs no compensation for specific gravity changes. It performs more reliably than expensive, sonic systems or electronic probes and costs little more than conventional float systems.

Only the
DYNAMATIC
Power Gauge Offers All These Advantages:

- 1/16 inch accuracy at depths from 0 to 60 feet.
- A continuously operating servo motor that keeps displacer constantly at surface of liquid level . . . 1/64 inch sensitivity to liquid-level changes.
- Automatic operation check through continuous power gauging action . . . direct reading at tank or remotely by electronic adaptation.
- Automatic compensation for variations in tape weight.
- All electrical equipment in explosion-proof enclosures.

*Trademark

For more information on the new DYNAMATIC 8400 Series, write for VAREC Bulletin CP3705, Dept. OGJ-1152-1.

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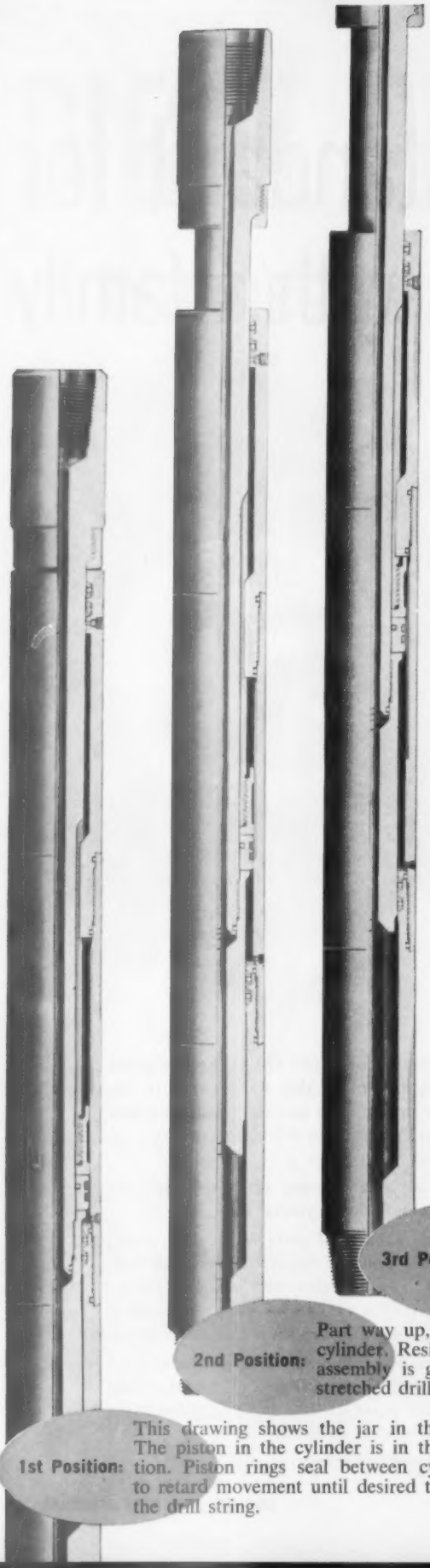


For Positive Operation, Long Life and Trouble-free Service use

Bowen HYDRAULIC ROTARY JARS

Here is a straight-pull jar that can be depended upon to deliver a blow of any intensity—from a light tap to the maximum impact that can be withstood by the run-in string. Even more important, it is easily controlled from the surface—no need to take up torque—no surface pre-setting. The impact intensity and frequency are easily and simply controlled by the operator by elevating the drill string at the speed required to strike a blow of the desired intensity.

Key to the outstanding performance is the patented Bowen Seal Ring Assembly which consists of Non-Extrusion Rings, Seal Protector Rings and "O"-Rings. The Seal Ring Assembly enables the Bowen Hydraulic Rotary Jar to withstand extreme differential pressures without failure.

Bowen Hydraulic Rotary Jars have been proved through years of use under all conceivable conditions. They have operated successfully at depths as great as 20,000 feet and temperatures above 390° F. Write for full information.

BOWEN

25th ANNIVERSARY 1935 1960

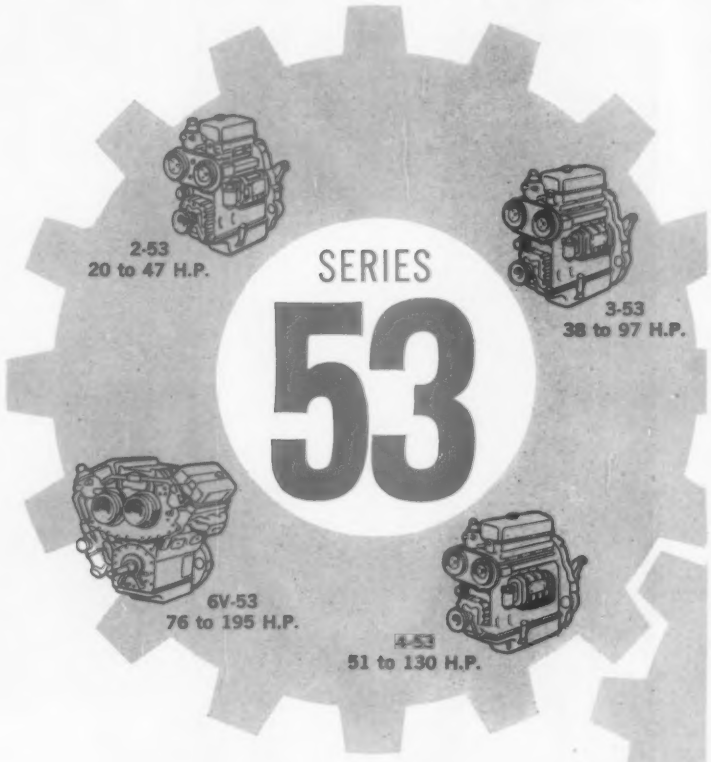
BOWEN ITCO, INC.
P. O. BOX 4587 • HOUSTON 13, TEXAS

3rd Position: At the upper limit of piston motion, the full energy potential stored in the drill string is available to jar the fish. The intensity of the blow is perfectly controllable, and the jar is easily reset by just setting the weight of the drill string on the jars.

2nd Position: Part way up, the piston enters the fluted section of the cylinder. Resistance to motion drops, and the jar's inner assembly is greatly accelerated by energy stored in the stretched drill string.

1st Position: This drawing shows the jar in the closed position. The piston in the cylinder is in the lowermost position. Piston rings seal between cylinder and piston to retard movement until desired tension is taken on the drill string.

GM sets the standard for DIESEL with a family ALL-PURPOSE POWER LINE



"A family of engines geared to every job." The farsighted engineering design which has made this statement a reality enables you to get all the savings built into the family of Series 53*, 71* and 110* engines. Yet you can still buy or specify your exact engine requirement.

You get engines tailored in power, size and weight to your exact needs—20 to 1650 H.P. in only three cylinder sizes.

Because of wide interchangeability of parts within the family, replacement parts cost less. You can protect new engines with current parts inventories. You can also meet changing horsepower needs and still keep the benefits of present operating know-how, maintenance training and existing parts inventories.

Wherever you use engines, you'll find Series 53*, 71* and 110* GM Diesels will raise your productivity—and profits. Your GM Diesel distributor can prove it—he's in the Yellow Pages under "Engines, Diesel," or write us direct.

**Refers to cubic inches displacement per cylinder.*

DIESEL PRODUCTIVITY

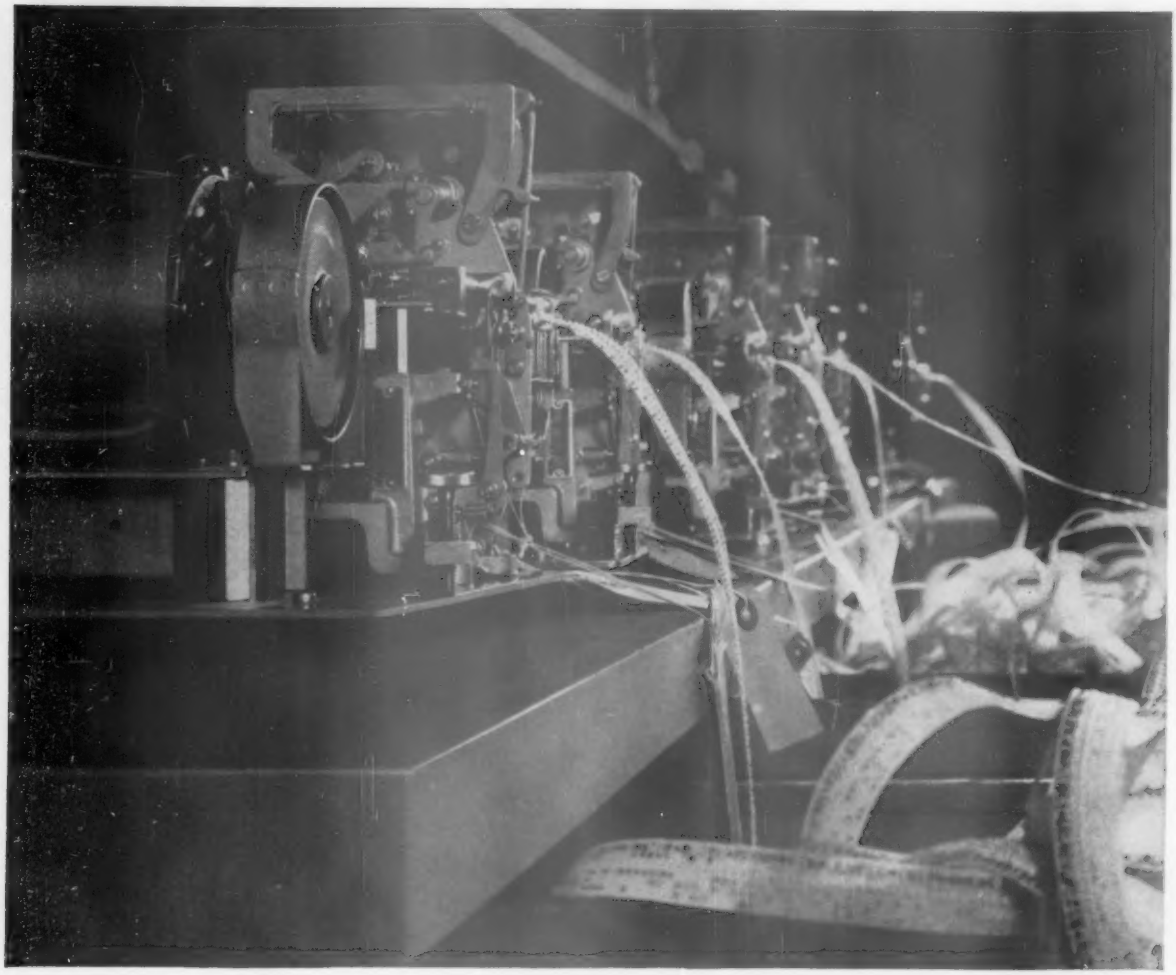
of engines geared to every job

CHOOSE FROM THREE SERIES...20 TO 1650 H.P....ONLY THREE CYLINDER SIZES

GM DIESEL

DETROIT DIESEL ENGINE DIVISION,
GENERAL MOTORS, DETROIT 28, MICH.

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario
Parts and Service Worldwide



Continuous operation— a Teletype equipment tradition

All Teletype equipment . . . like the tape punches being final-tested above . . . are subjected to a rigorous quality-control program to insure that the units will give continuous, day-in, day-out performance in your service. Such performance is a Teletype tradition, established during more than fifty years of manufacturing data communications equipment.

To maintain this performance tradition requires much more than testing, however rigorous. It begins with the very design of the units themselves—the product of extensive research and development facilities, backed by cumulative experience. And it involves precision manufacture—employing the latest technological advances, from highly specialized machine tools and automated processes to electronic measuring and sensing devices.

When you select Teletype equipment to speed your communications and cut your paperwork costs, you can be sure of built-in quality. Teletype Corporation manufactures this equipment for the Bell System and others who require the utmost reliability from their data communications systems.

Typing Tape Punch

Tape Reader

Send-Receive Page Printer

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by oil men who have used all kinds of gauges

The ten-gallon hat on the Marsh Mastergauge is worn as a crown of acceptance, an emblem of excellence... well earned through years of rugged oil country service.

Just as kings ascend thrones through lineage, the Mastergauge was destined for "royal" acclaim the day it hit the drafting board. Because every product born at Marsh is "born to the purple."

For what other gauge has the Marsh heritage of functional design innovations? Only Marsh offers Conoweld construction, the Marshalloy case, "coined" sector Mastergauge movement, "Recalibrator" adjustment, and optional Safecase protection plus.

That's why we say the *next* great thing that happens in gauges will happen at Marsh.

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"THE STANDARD OF ACCURACY"

OTIS PRODUCTION NEWS

Volume 1, Number 1 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*

Special Report from West Texas

Otis Production Packers Hold Where Others Fail

High Pressure, Strain, Tubing Vibration in Gas-Injection Wells Cause Bodies of Competitive Packers to Part

MIDLAND — Type WA Otis Production Packers have proved to be the solution to a serious problem encountered by a West Texas operator on a secondary recovery project. The problem was to find a packer that would stand the stress and vibration of the tubing in a number of high-pressure gas-injection wells.

The wells involved were being used to inject gas into the Devonian at approximately 12,500 feet. Injection rate was 2½ M.C.F.D. at 7,500 P.S.I. Due to vibration created by this high rate of injection, the tubing was set in tension with a minimum of 25,000 pounds' strain. These conditions apparently proved too strenuous for the packers used in the initial completion for they disintegrated shortly after the wells were put into operation.

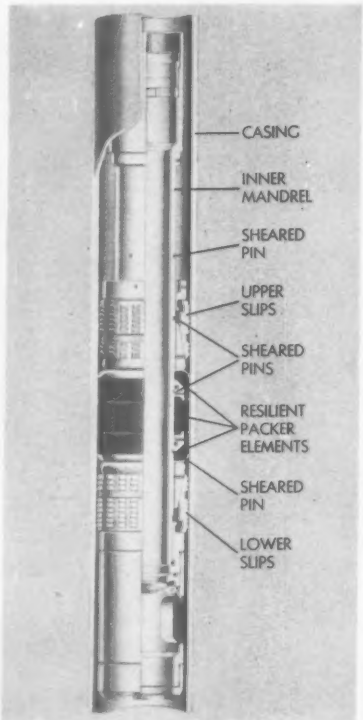
In analyzing this producer's problem, Otis packer specialists from the Odessa office felt confident the Type WA Otis Production Packer would stay in the hole in spite of the adverse working conditions because of the packer's "floating mandrel" design.

See diagram this page

This feature, unique among permanent-type retainer packers, is designed to prevent problems such as this which result when a packer's inner mandrel is permanently attached to the slips or packer body.

Unlike the packers originally used in these wells, the inner mandrel of the Type WA Otis Packer is not pinned to either the upper or lower slips, or the rubber element assembly, once the packer has been set. The mandrel is free to travel up or down within the outer packer body approximately 8 inches before being confined by a shoulder at either end, and is sealed off and held in position by O-rings and pressure from the compressed rubber packer elements. In this way, vibration or movement of the tubing string when transmitted to the packer mandrel is partially absorbed by the rubber packer elements first, and not directly transmitted to the slips or the outer packer body.

As a result, Type WA Otis Production Packers have replaced the packers originally used in these injection wells and the operator reports all have proved satisfactory. Several additional wells are to be drilled for this project and Type WA Packers have been specified for each.



When setting the Type WA Otis Production Packer, all pins holding the slips and resilient packer elements in the running position are sheared and the mandrel is free to float.

© 1960 O.E.C.

Drilling and Producing Division Heralds Otis' Entry Into Packer Field As 'Good News'

DALLAS — The news that Otis has acquired a new line of field-proven production packers and bridge plugs, and is now offering a "packaged" well completion service, has been well received by the drilling and producing division of the petroleum industry.

For the last 25 years, producing companies and packer manufacturers both have looked to Otis for guidance when engineering difficult well completions. Now, with its own line of packers, Otis will provide the industry a "packaged" well completion service to include both engineering and all sub-surface equipment.

The present line of Otis packers includes a series of Type WA Wire Line Set Drillable Retainer Packers which can be set on any wire line pressure setting tool; three tubing or drill pipe set packers which carry the designations Type TA, TB, and TE; a Type RA Retrievable Packer designed to be set in tension or com-

(See "Good News," Page 2, Col. 2)

Better Production Tools Through Research

Otis-Engineered Dual-Completion Saves Tubing Job 30 Days Following Initial Completion

THOMPSON CREEK FIELD, MISS. — A well, dually-completed in this western Mississippi field in November, 1959, produced approximately 200 B.O.P.D. from each zone immediately following completion, however both zones had to be put on pump in less than thirty days due to a decrease in bottom-hole pressure. The well completion, engineered by Otis specialists in that area, was designed to permit the operator to flow this well as long as economically feasible, then put both zones on pump without pulling tubing.

The well was completed with two packers, a dual and a single, a Type S Otis Landing Nipple and a Type A Otis Sliding Side-Door between the two packers for plugging and circulating purposes, and two Type S Otis Landing Nipples above the top packer in each string.

See schematic diagram — right

The conversion of this well to artificial lift was accomplished by landing Type S Otis Pump Locators and Hold-Downs in the top S nipple of each string and installing the pumps. As the zones deplete, the pump locators and hold-downs may be reset in the lower nipple of each string simply by pulling the pumps, retrieving the locators and hold-downs, changing the selective keys on the locators, and re-running the tools to the lower nipple. By using Type S Otis Landing Nipples instead of regular A.P.I. pump seating nipples, the tubing remains full-opening to permit running through-tubing perforating guns, bottom-hole pressure bombs, and other wire line service tools. Also, plug chokes and other Otis sub-surface flow control equipment may be set in any of the S nipples should it become necessary.

Good News

(Continued from Page 1)

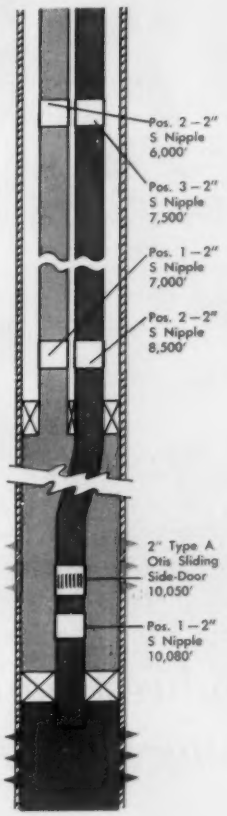
pression without modification; the Type HS Retrievable Isolation Packer which is set hydraulically, and two retrievable collet-type packers — one for slim-hole work and the other a regular casing collet-type packer.

A stepped-up research and development program is expected to produce several new types of packers in the immediate future to further round out the line of packers Otis already offers.

As part of the company's expansion program into the packer and bridge plug field, highly skilled packer specialists have been added to the staff of each Otis division. These men, working with other Otis well completion experts, form a team that operators can look to for a "packaged" well completion . . . as a single supply source for *all* necessary sub-surface completion equipment — from the wellhead to the plug on bottom.

Tool and Service Information

For additional information on any of the equipment reported in this issue of the Otis Production News, contact your nearest Otis office or write Otis Engineering Corporation, Dept. 1-P, Box 35206, Dallas 35, Texas. You'll find your Otis specialist ready to help you — anxious to serve you.



OTIS

Engineering Corporation

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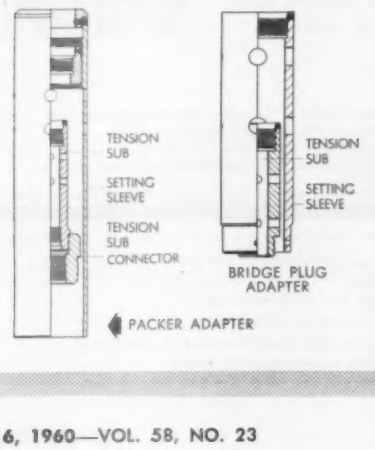


New Otis Packer and Bridge Plug Pressure Setting Tool Adapter Kits

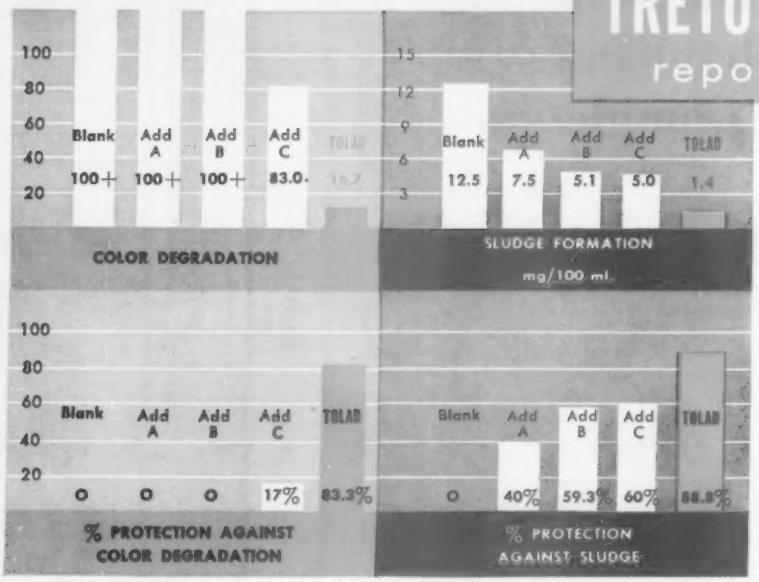
Special pressure setting tool adapter kits have been developed to permit Type WA Otis Production Packers and Otis Wire Line Bridge Plugs to be set on the No. 20 pressure setting tool. Both of the adapter kits are extremely simple in design and can be easily made up with the setting tool.

The packer adapter kit consists of a tension sub, setting sleeve, and tension sub connector which is made up on top of the WA packer on the rig floor. The adapter for the bridge plug consists of only two sub-assemblies, a tension sub and a setting sleeve.

Both kits have been extensively tested in the laboratory and in the field, and neither has failed to operate as designed.

another

TRETOLITE SERVICE report



These bar charts illustrate the results on some of the comparative tests conducted. Additive "B" was the additive which TOLAD replaced.

Midwest marketer stops complaints on fuel by using TOLAD® FUEL ADDITIVE *a new Tretolite Company product*

During the 1957-58 heating season, a midwestern oil company was plagued with an excessive number of customer complaints. The complaints stemmed from the frequent plugging of filters in domestic heating systems. The problem was complicated by the fact that the refiner was using a commercial additive intended to stabilize the fuel oil and prevent such difficulties.

The company surveyed household fuel tanks of their product users and inspected fuel system filters. In every case it was noted that the fuel was highly unstable, that sludging was prevalent, and that the sludge was plugging the filters. This survey also disclosed excessive emulsification and severe color degradation.

The refiner carried out a series of comparative tests in an effort to find an effective additive which would insure fuel oil stability. As a result of the tests, TOLAD Fuel Additive was selected, and used during the 1958-59 heating season.

As a result, complaints were reduced to a very few, and these were attributable to faulty burner adjustment. The use of TOLAD is now routine with this refiner. A continuing test program indicates that the fuel products are stable and consistently salable.

If you are interested in improving the storage stability of your fuel oils, and cutting additive costs at the same time, get the facts about TOLAD Fuel Additive. Ask your Tretolite refinery service engineer, or write . . .

*Registered Trademark, Petrolite Corporation

FA-60-3

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WECO UNIONS

Unretouched photos of unions subjected to an offshore water splash test for several months. Notice the protection afforded by the "33" coating.

COATED

UNCOATED

available with "33" coating for corrosion resistance and full insulation

"33" coating can be applied to any size or pressure-rated WECO Union for greater protection against corrosive action . . . for high resistance to electrolytic action.

Applied by a special process to internal and external surfaces of both subs and wing nut, "33" coating gives WECO Unions maximum protection against corrosion in offshore, coastal, and other installations where corrosive conditions are prevelant. In addition the "33" coating provides full insulation against electrolytic action.

"33" coating is tough and flexible, has been extensively tested in the laboratory and field. WECO Unions with "33" coating have been made-up and broken-out hundreds of times without destroying the electrolytic and corrosion protection of the coating.

To specify WECO unions with "33" coating simply add "33" to the figure number of the WECO Unions you want.

WECO

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS
Division of CHIKSAN COMPANY a subsidiary of FOOD MACHINERY AND CHEMICAL CORPORATION

AO-1-60

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WECO UNIONS

CHIKSAN SWIVEL JOINTS

HAMER LINE BLIND VALVES

HAMER PLUG VALVES

"... thinking about big business based on myth or on conditions that no longer exist, or actions that spring from insufficient understanding, bias, emotion, or political opportunism, can do immense harm to our country, and can adversely affect the fortunes of the average citizen."

— M. J. Rathbone, President

ESSO

Standard Oil Company (New Jersey)

Standing two stories tall, the vertical plate shot blast can clean plate ten feet wide and forty feet long

NEW AT BEAIRD

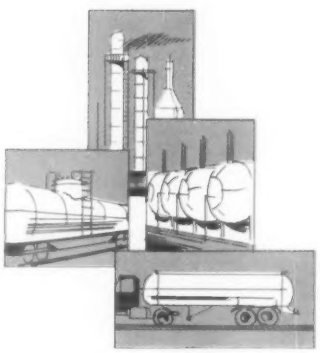
Assembly Line Vertical Plate Shot Blasting

Plate used in fabrication at Beaird is shot blasted cleaner than the proverbial whistle. Mill scale and foreign material are scoured off to provide a longer lasting paint bond, improve weld quality and free tank interiors from loose particles that may clog lines or contaminate product. Yet assembly line planning at Beaird has made this new service available without added cost to customers.

The vertical plate shot blasting system is just one of the many important equipment additions that are part of Beaird's planned facilities growth. Other new items include a 600-ton Gap Frame Press, 20-foot Plate Bending Rolls, Large Boom Welders, a 100-ton Bridge Type Crane and Precision Flame Planner for plate edge preparation.

Beaird is daily adding to its list of manufacturing accomplishments with such products as aluminum and alloy rail tank cars, stainless steel fractionating towers, giant pulp wood digesters and other specialized pressure vessels.

Check with Beaird on your next heavy steel or alloy product . . . you may save both time and money.



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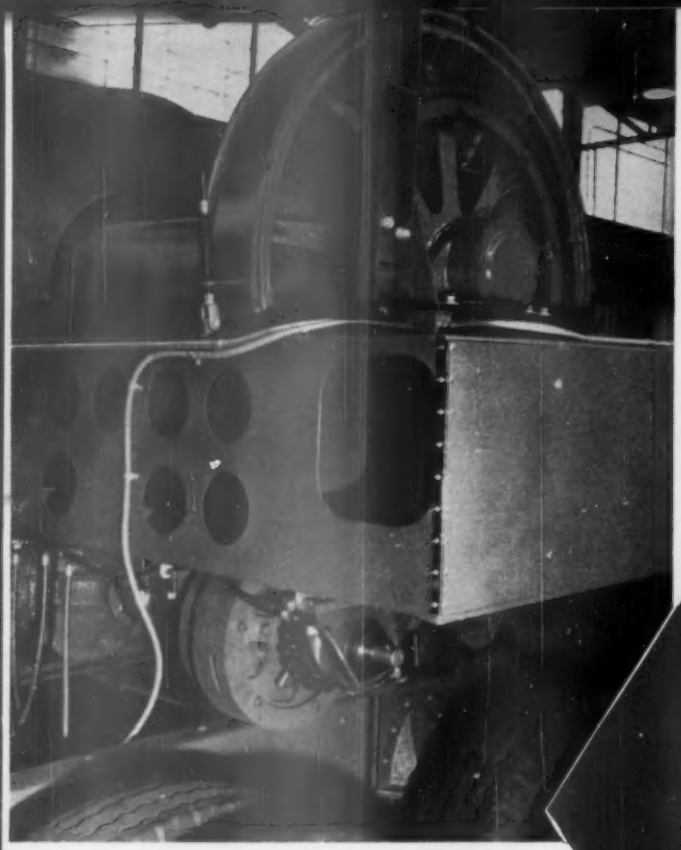

"For our needs a Wichita Clutch means RELIABILITY!"

say the engineers
of
SCHLUMBERGER
Well Surveying Corp.

"Reliability of clutch operation is the greatest benefit to our application. WHY? Because breakdowns during operations in an oil well could cause loss of our instruments and thousands of dollars in drilling rig operating expenses. We have therefore chosen Wichita Clutches for the Winch drive of our units. They have performed well throughout tests and field operations."

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Contact your nearest Wichita Engineer!

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Smith-Keser & Co., Avon, Conn., Philadelphia 44, Pa., and New York, N. Y.
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AN EXTRA 2000 TO 4000 BARRELS A DAY PER STILL

One eastern refinery increased the capacity of a pipe still from 16,000 barrels a day to between 18 and 20,000 — by modernizing the still in a program that included a Ljungstrom® Air Preheater.

The Ljungstrom boosts throughput like this by recovering waste heat from stack gas and putting it back to work in the combustion chamber. If you modernize to take full advantage of Ljungstrom's heat recovery efficiency, you also get much closer temperature control. At the refinery mentioned above, modern fuel-burning equipment — combined with Ljungstrom — increased product ratings an average of two octane numbers.

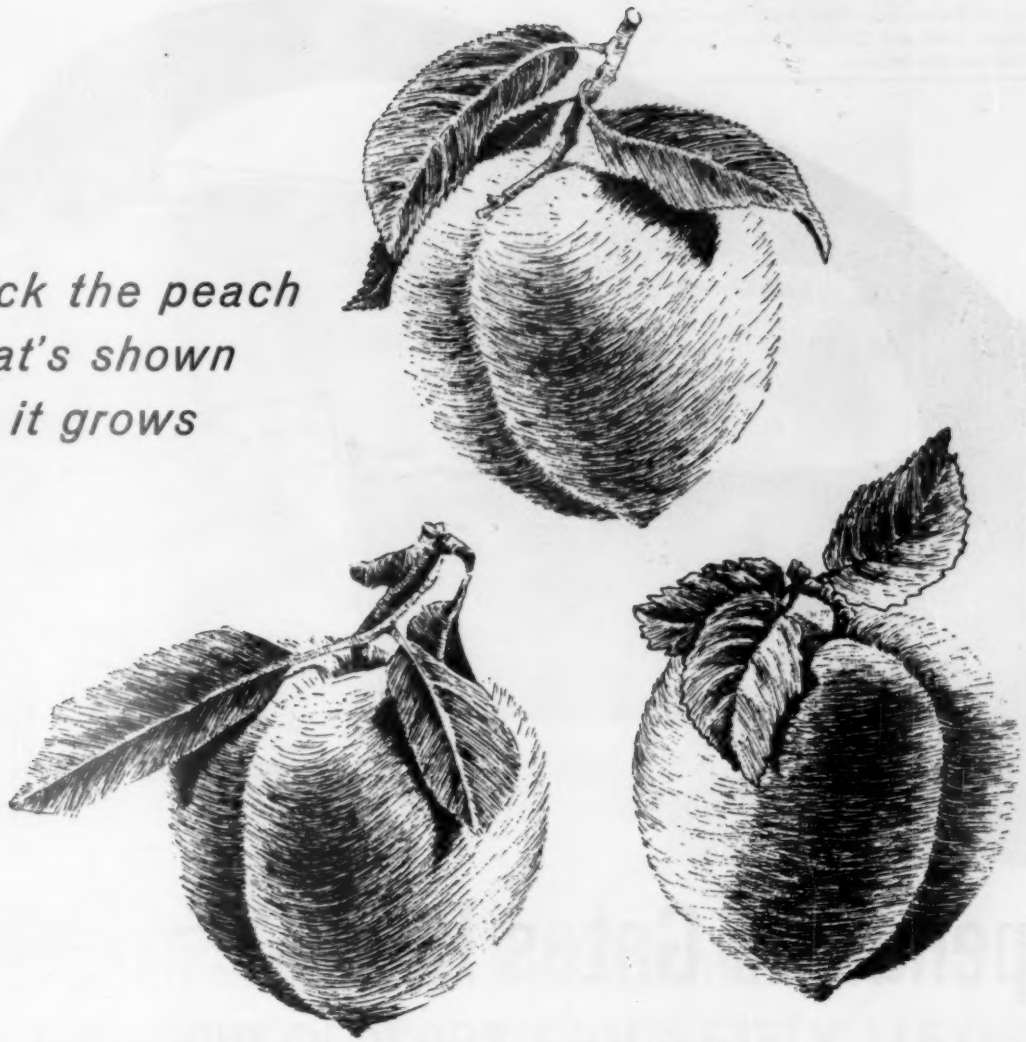
The addition of a Ljungstrom Air Preheater can materially increase the capacity of your equipment. Every inch of a Ljungstrom heat exchange surface is as efficient as a foot of tubular heat exchanger.

For more complete details on what the Ljungstrom Air Preheater can do for you, or for a complete analysis of the heat recovery benefits, call or write The Air Preheater Corporation.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

Pick the peach that's shown as it grows



Can you tell the real thing when you see it?

It pays to know the fine points . . . in peaches, or products for petroleum processing.

Take liquid caustic. How you get it is almost as important as what you get. Wyandotte can ship caustic to you by barge or ocean tanker, truck or tank car . . . from Geismar, Louisiana (near the mouth of the Mississippi), or from Wyandotte, Michigan (directly accessible to the Great Lakes and the St. Lawrence Seaway). The right choice for you depends on a number of factors. We're familiar with all of them, and would like to help you evaluate them. Call on us.

Wyandotte offers a number of chemicals for the petroleum industry, including materials for drilling muds, gas dehumidification, demulsifying, emulsifying, secondary recovery, water treatment, cementing, sweetening and many other petroleum, refinery, and petrochemical applications. Get full details from your distributor, or write: *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Baton Rouge, Louisiana. Offices in principal cities.*

ANSWER: You're a pretty sharp picker of peaches if you picked the peach on the top. It's the only one that's paired with a peach leaf. The leaf on the left belongs to an apple, and the one on the right to a pear.

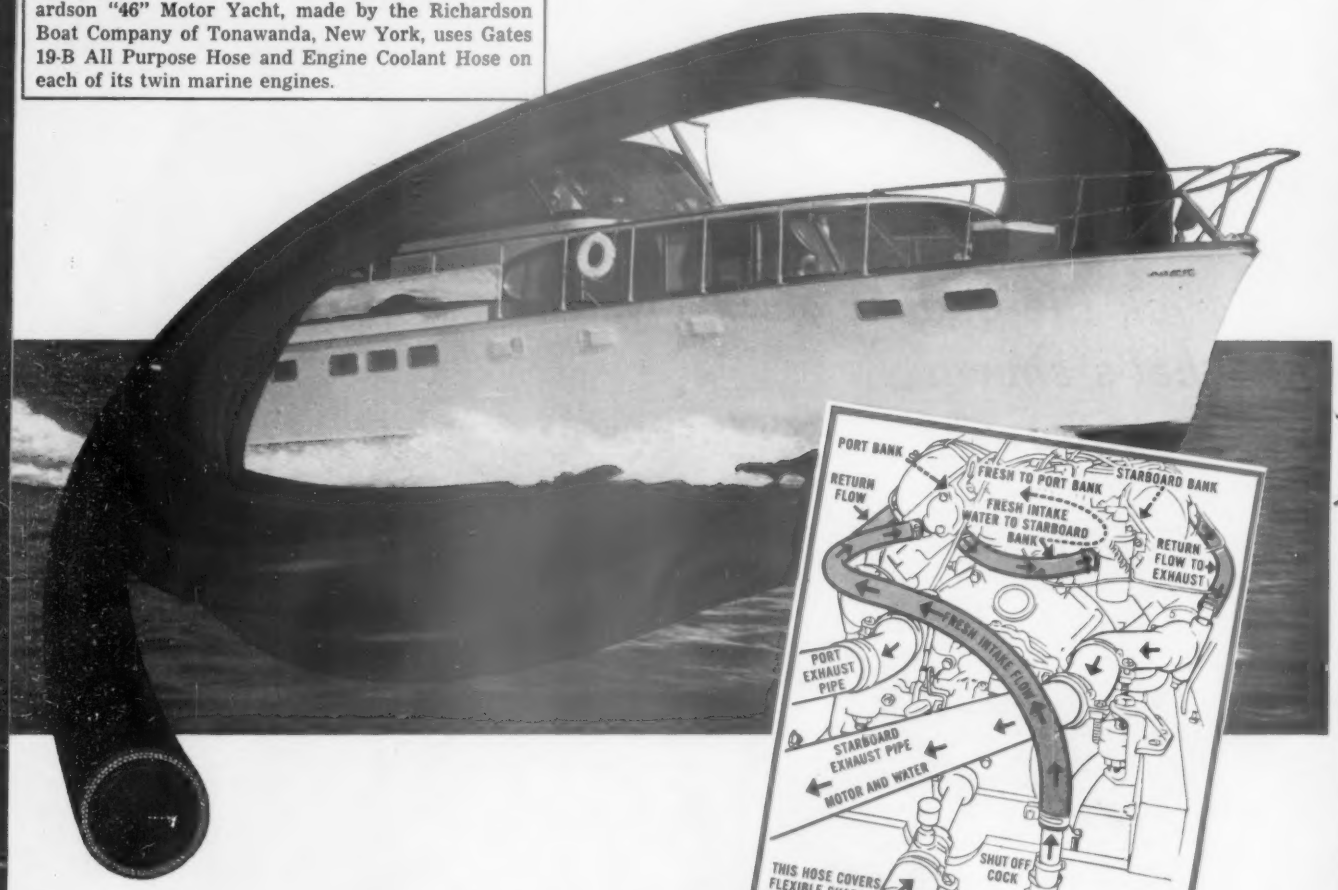
* * * * *

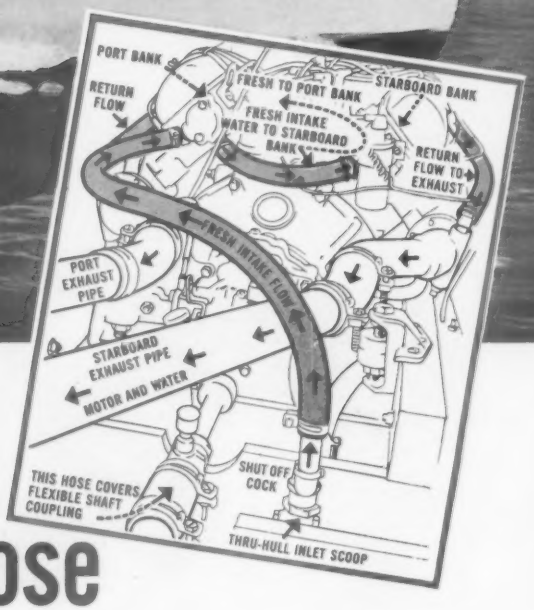
WYANDOTTE CHEMICALS

MICHIGAN ALKALI DIVISION

Pacing progress with creative chemistry®

You find Gates Hose where anything flows. The Richardson "46" Motor Yacht, made by the Richardson Boat Company of Tonawanda, New York, uses Gates 19-B All Purpose Hose and Engine Coolant Hose on each of its twin marine engines.





Dependable Gates Hose makes for "cool" cruising

Whether it's for air, water, steam, oil or suction, there is a Gates Hose of the right type and size for the continued safe performance of all types of equipment—at sea, on land, or in the air.

Back of the world-wide acceptance of Gates Hose is a continuing program of specialized hose research at the multi-million dollar Gates Research Center. The aim of this program is to broaden the usefulness and lengthen the life of hose for all industries.

Distributors of Gates Industrial Hose are listed in the Yellow Pages of phone books in all major industrial centers. Performance of this product is guaranteed by the *World's Largest Maker of V-Belts.*

Gates Type 19-B Hose carries air, water, coolants, oils, greases, gasoline, kerosene, or solvents. This popular hose—one of many in Gates full line—is always available from your nearby Gates Distributor.

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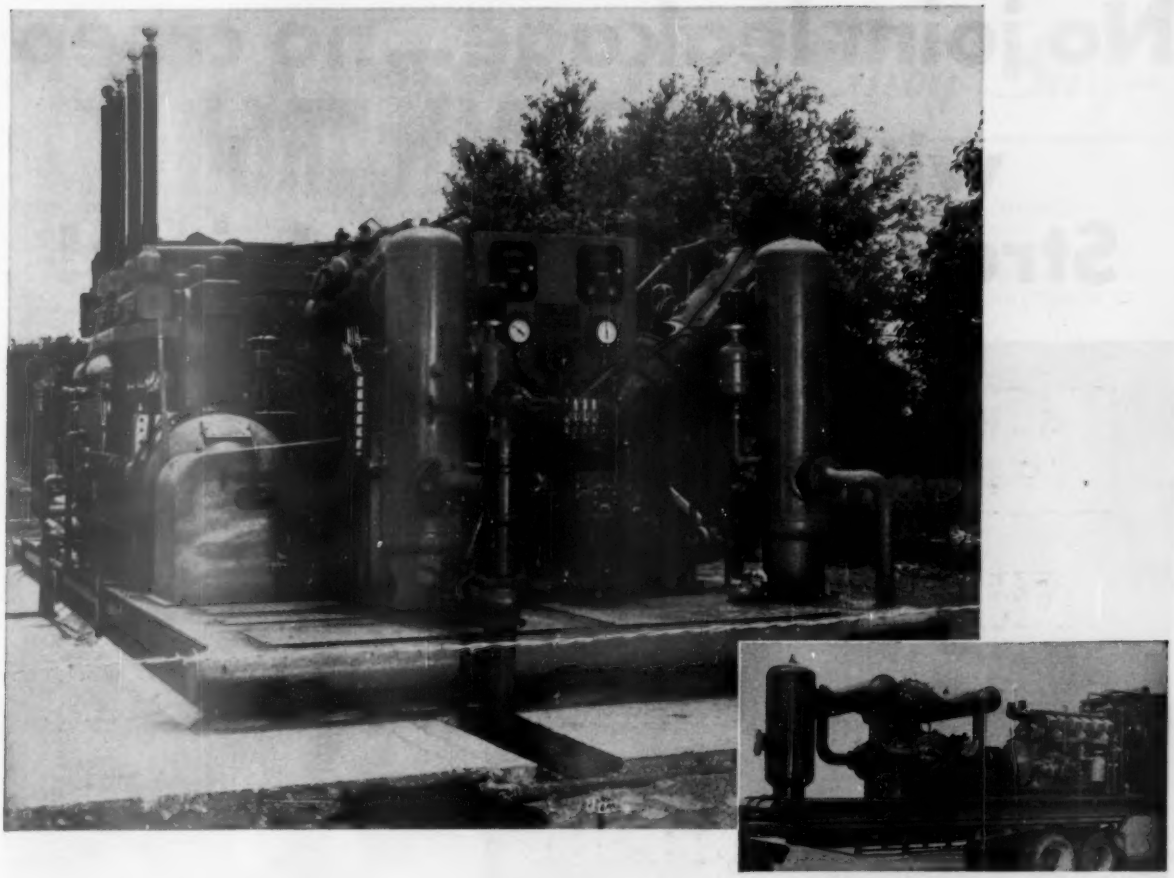
Gates Industrial Hose

Made in a Full Range of Types and Sizes



INTERCHANGEABLE CYLINDERS MAKE JOY GAS COMPRESSORS COMPLETELY FLEXIBLE

For unknown conditions in the well, or for rapidly changing conditions, only Joy gas gathering compressors give you the flexibility you need.

If operating conditions change, you can vary the compressor capacity by changing the cylinder liners. For extreme changes in operation, you can change the complete cylinder assembly, because *any Joy cylinder fits any Joy frame.* All cylinders accommodate a 7″ piston stroke, and all Joy compressors operate at 600 rpm.

This modern uniform design gives you a gas booster that fits any condition, any service . . . even moves to other locations. The entire unit is designed within normal size limits for highway transportation. For the flexibility you need in gas boosters, see your nearest Joy distributor-fabricator listed here, or write for bulletin 1211-31.

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No worry about joint leakage or creep with our 4 POINT SEAL PROTECTION . . . in fact, the seal actually becomes TIGHTER as the tension load and pump pressure are increased.

AMERICAN IRON Straight Grip tool joints are *three times* as strong as the pipe they connect! You'll like the quick, easy way this hand applied Straight Grip can be removed and installed right at the rig. STRAIGHT GRIP tool joints are ideal for handling high tensile drill pipe.

These are just a few of the reasons why you buy quality when you specify AMERICAN IRON.

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They Say—

Davis deserves mention

Dear Sir:

I thought I'd never see the day when I would write a complaint letter to the Journal.

But, in your May 9 story about the petroleum marketing course at the University of Tulsa (p. 108), you omitted an important name. You left out B. R. Davis, trade relations manager for DX Sunray, who is chairman of the committee you listed.

Charles D. Schnake
Public Relations Supervisor
Sunray Mid-Continent Oil Co.
Tulsa

(Editor's note: We regret the omission. Mr. Davis developed the idea of a marketing course, presented it to the university and to other companies. Sunray gave him unlimited time to get the project started. Besides heading the general committee, he is chairman of the executive committee.)

Surprising editorializing

Dear Sir:

While Dr. Gardner was doing some "snooping at AAPG headquarters," as indicated in the article of May 16 (p. 219) it is regrettable that he did not find more accurate information regarding the 1961 meeting in Denver.

This is most definitely not "a case of a national meeting replacing a regional" meeting. The meeting which will be held in Denver April 24-27, 1961, is a joint meeting of the AAPG, SEPM, and Rocky Mountain section of AAPG. My positions as president of the section and as co-chairman of the convention's technical program committee are far from coincidence.

The plan for this joint meeting started with George Buchanan, then president of AAPG, at the Rocky Mountain section meeting in Albuquerque in 1959, was encouraged by Weeks in 1960, and is now strongly supported by Parker. The "coincidence" of a "suggested cure" in your article seems to be your discovery of this line of thinking.

My first inclination is to try to give you all the information you should have had before writing the critique. This, however, seems pointless, since the harm has already been done.

This kind of editorializing is something readers have come to expect from some newspapers. It is something

INTRODUCING

FOR THE SMALL RIG OR PRODUCTION HOISTS

TYPE "G" WEIGHT INDICATOR

The Type "G" is a scaled down version of the Martin-Decker "E," "D," and "FS" Indicators and includes the Sensater mounted in the National Supply Co. Dead-line Anchor. This gives the small rigs, workover or production hoists the finest possible instrumentation.

The National Anchor with Sensater installed

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Write for descriptive literature **D-P95**

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quite surprising from a journal that usually knows what it is talking about.

O. E. Childs, President
Rocky Mountain section
American Association of
Petroleum Geologists

How about summer meeting?

Dear Sir:

I read with considerable interest your article concerning the lack of attendance at the recent AAPG convention in Atlantic City (OGJ, May 16, "AAPG National Meeting: Retrench—or Think Big?" p. 219). I was also interested in some of the possible solutions which you discussed.

For some time I have felt that it would be beneficial to most of the young geologists to hold this convention in the summer months. This feeling is shared by many of my friends.

I feel that a convention during this time of year would attract many of us who have children in school. This group might fall into one of two categories: (1) young geologists who are sent by their companies; (2) young geologists who are eager to attend the convention, but are not sent by their company. They could attend at their own expense more easily when the convention trip coincided with their vacation.

Since most of our young AAPG members have children in school, it is impossible to attend this convention in conjunction with a vacation when it is held during the school year. I feel certain that moving the convention date to a summer month would greatly enhance attendance, especially for the younger members.

Owen C. Brown, Jr.
Argo Oil Corp.
New Orleans

Oversupply in Canada

"Even if the Montreal market were to be supplied by Canadian crude oil, the continuing growth of the producing industry in western Canada at a rate in excess of the normal rate of growth in our own domestic requirements, must depend, in the long run, on expansion of export markets in the United States.

"We believe it would be most unwise at this time to take any precipitate action to expand our existing markets in either Canada or the United States, at the risk of jeopardizing the export markets in the United States to which we already have access and to which we must look for major expansion of Canadian production in the future.

"To a certain extent, in the current situation of oversupply in western

RIGHT. Operating diagram of Darling gate principle. Fully revolving discs and complete release of wedging pressure during gate travel assure uniform wear distribution. Closure wedging automatically provides seating compensation for pressure-tight seating every time.

How Darling gate valves can help

MAINTAIN PROCESS SCHEDULES

THE unique Darling gate valve principle, diagrammed above, provides today's best assurance of prolonged good behavior and avoidance of leaks and process interruptions! It's a natural where the most reliable operation is vital month in, month out.

You'll find this feature in Darling's economical hard-rubber-lined iron body valves for corrosion services up to 150 pounds. Same goes for other Darling gate valves in sizes, types and metals of various alloys for all kinds of normal and unusual services. Write for Catalog No. 57.

ENGINEERING SERVICE: Darling offers unusual facilities for the development and manufacture of special valves for out-of-the-ordinary requirements. This special service is available to you at all times, without obligation.

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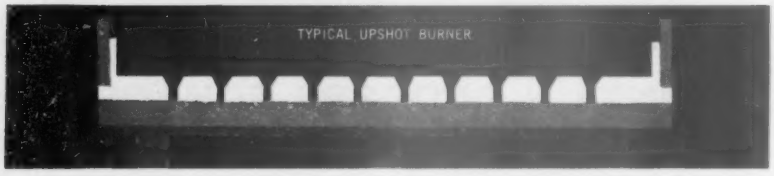
The characteristic volume stability of Purocast makes it particularly suitable for high temperature burner blocks in the refinery oil heater.



Ask your Kaiser Refractories Sales Engineer how you can make all of your own burner blocks with Purocast—in your plant—and get these advantages:

Longer life without failure. Good uses of unassigned manpower to cast blocks in advance. Reduced inventory. Freight savings. And assurance that you can replace any shape block 24 hours after pouring—regain full heating in as little as 48 hours!

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Mexico Refractories now merged with Kaiser Refractories

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KAISER CENTER, OAKLAND 12, CALIFORNIA

Please send me information about Kaiser Purocast with instructions for casting and curing burner blocks

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COMPANY_____

ADDRESS_____

CITY_____ STATE_____

Canada, it might be said that the industry is the author of its own misfortune. As a result of the unnecessarily high level of exploration and development activity in recent years, our potential capacity to produce has far outstripped available markets.

"We believe that the gap between production and producing potential will be gradually narrowed by the continuing growth in economic markets, provided we do not substantially exceed the level of activity in the past year.

"We would be concerned, however, that a sudden expansion of our present markets by an enforced movement of Canadian crude oil into Montreal would touch off another feverish round of greatly stepped-up activity in exploration and development, which would inevitably lead to a situation of oversupply similar to that in which we find ourselves today.

"It would be a wise course for the industry to exercise a measure of patience and to concentrate on the orderly development of economic markets, rather than to attempt to accelerate unduly the current rate of expansion."

E. D. Loughney, president, British American Oil Co., Ltd., in a speech to company shareholders.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

JUNE

6-7 Petroleum Electric Power Association, annual conference, Hotel King Edward, Jackson, Miss.

9-11 Manufacturing Chemists' Association, annual meeting, The Greenbrier, White Sulphur Springs, W. Va.

13-15 American Association of Cost Engineers, annual meeting, Rice Hotel, Houston.

13-15 Chemical Institute of Canada, annual conference and exhibition, Chateau Laurier, Ottawa.

13-15 Interstate Oil Compact Commission, midyear meeting, Statler Hilton Hotel, Detroit.

15-16 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Hotel Lassen, Wichita.

16-18 International Oil Scouts Association, annual meeting, Biltmore Hotel, Los Angeles.

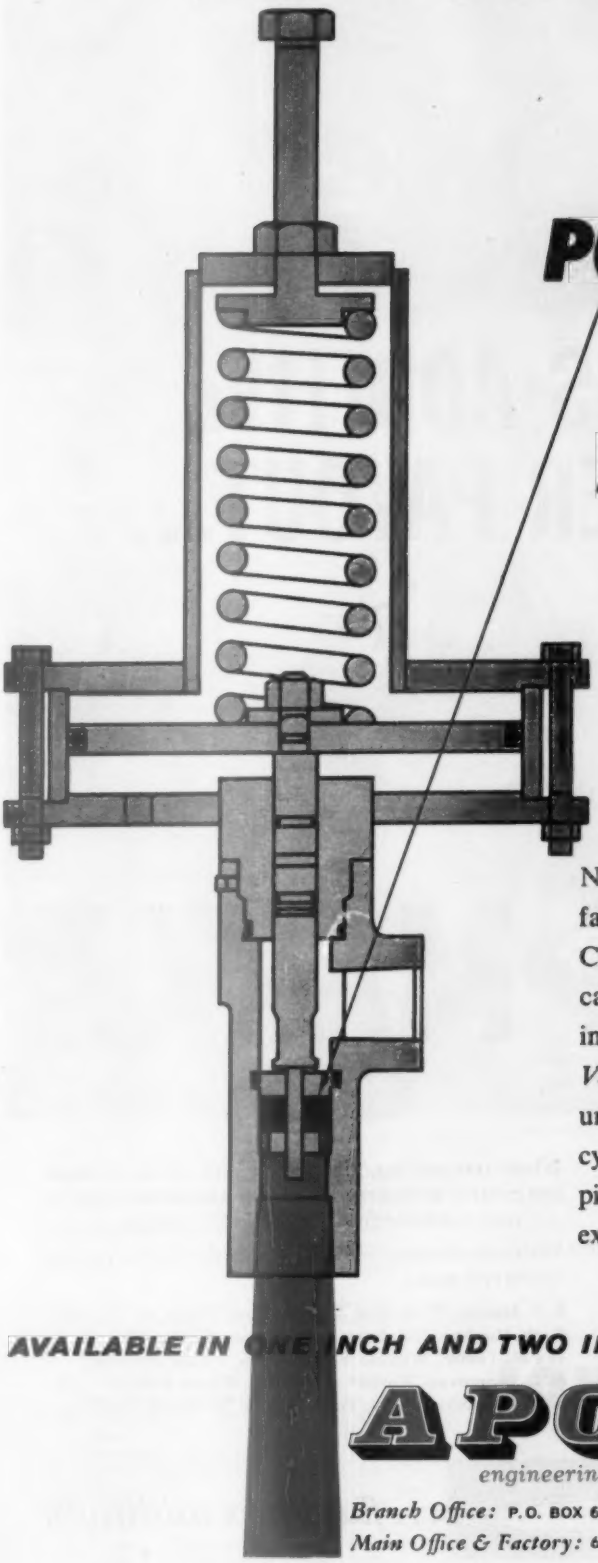
19-22 American Institute of Chemical Engineers, Instituto Mexicano de Ingenieros Quimicos, joint meeting, Hotel Del Prado, Mexico City.

22-25 Canadian Gas Association, annual meeting, Manoir Richelieu, Murray Bay, Quebec.

22-25 American Association of Petroleum Landmen, national convention, Ambassador Hotel, Los Angeles.

(Continued on page 57)

Here's a liquid dump valve with...



POSITIVE SHUT OFF *that* STOPS LEAKAGE

The Check-Stream DUMP VALVE

Now you can stop leakage, the major cause of failure in conventional dump valves, with the new Check-Stream Dump Valve. Even the smallest leak can cause an erosive action that can ruin your valve in a very short time. *The Check-Stream Dump Valve gives positive shut off* . . . it will not leak even under the most severe conditions. A solid rubber cylinder, expanded against the body liner by a piston motor, provides positive shut off as well as extremely fine throttling action.

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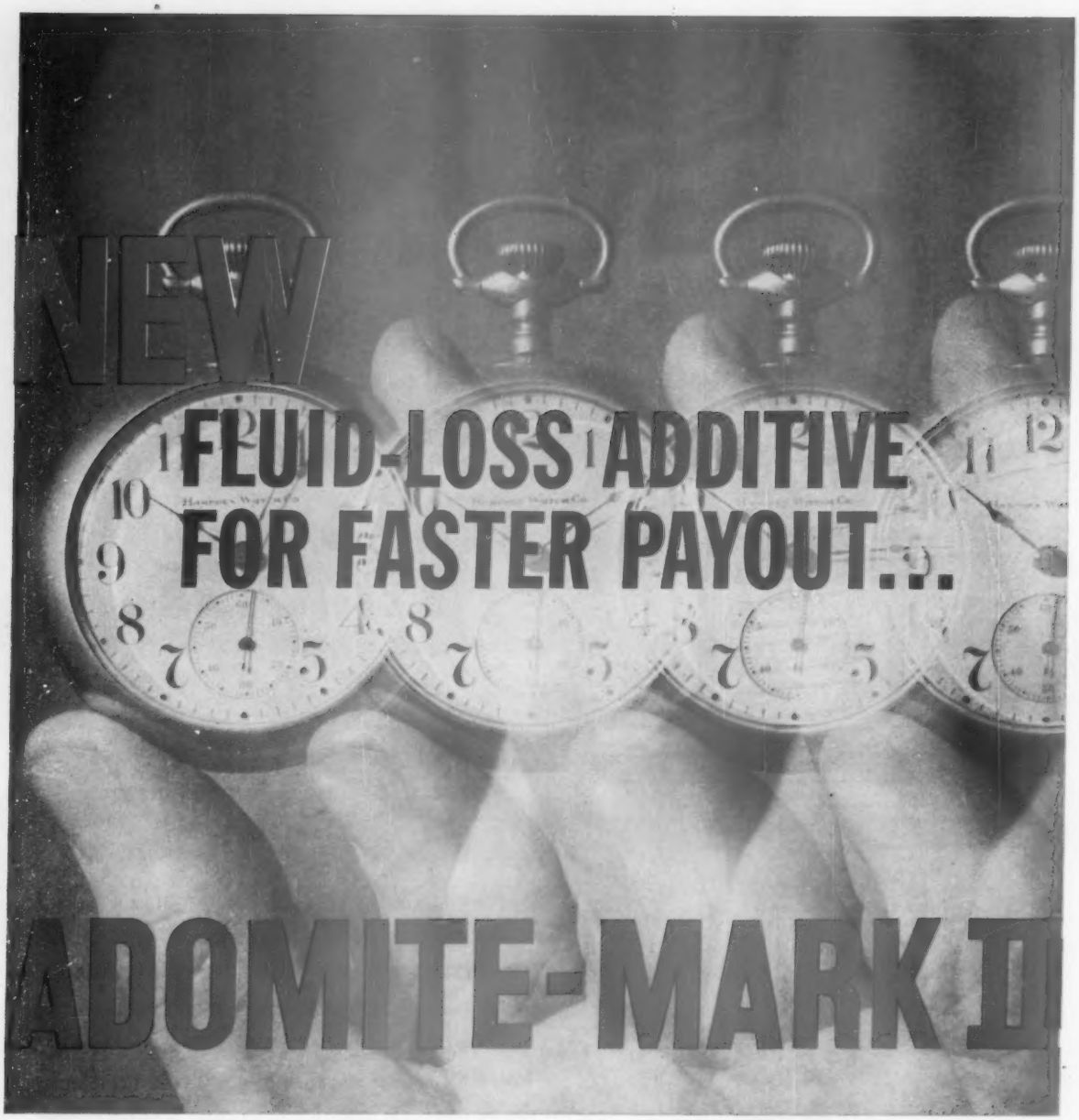

Now—from the makers of ADOMITE comes the last word in fluid-loss additives—new ADOMITE-MARK II. Regardless of the kind of fracturing oil medium you use, new ADOMITE-MARK II will give the fullest possible fluid-loss control. Result? Larger fractures and faster payouts every time!

You, along with many other producers, may want to continue to standardize on ADOMITE, proven in over 20,000 fracturing treatments to be an efficient fluid-loss control additive for a wide range of crudes.

Where unusual conditions exist and optimum fluid-loss control is imperative, ask for ADOMITE-MARK II . . . now available from your service company.

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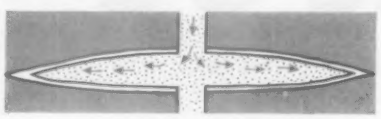
R. W. Hughes, Oklahoma City, Okla., CEntral 2-1371
Joe M. Foster, Wichita Falls, Texas, Phone 723-8181
H. L. Thomason, Casper, Wyoming, Phone 3-3721
J. D. Hawsey, Pampa, Texas, Phone MOhawk 5-2992

ADOMITE®  *. . . fluid-loss additives*

22-July 1 University of Michigan, engineering summer conference, topics in multiphase flow, Ann Arbor, Mich.

25-29 Petroleum Equipment Suppliers Association, annual meeting, Banff Springs Hotel, Banff, Alta.

25-July 5 First International Congress for Automatic Control, Moscow, USSR.

26-28 North American Gasoline Tax Conference, annual meeting, southern region, Eden Roc Hotel, Miami Beach.

26-July 1 American Society for Testing Materials, annual meeting and exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J.

27-28 Michigan Gas Association, Mackinac Island, Mich.

JULY

11-20 University of Michigan, engineering summer conference, applied mathematics for chemical and metallurgical engineers, Ann Arbor, Mich.

18-29 Massachusetts Institute of Technology, dynamics and control of chemical engineering processes program, Cambridge, Mass.

28-30 American Petroleum Institute, Division of Production, Eastern district meeting, The Greenbrier, White Sulphur, Springs, W. Va.

AUGUST

3-5 Wyoming Geological Association, field trip to Snyder basin and Wind River Mountains, Casper.

14-19 National Congress of Petroleum Retailers, Inc., annual session, Shamrock-Hilton Hotel, Houston.

15-17 American Society of Mechanical Engineers, American Institute of Chemical Engineers, heat transfer conference and exhibit, Statler Hilton Hotel, Buffalo, N. Y.

15-26 Sacramento State College, summer institute on nondestructive testing, Sacramento, Calif.

22-26 Gordon Research Conference, catalysis, Colby Junior College, New London, N. H.

29-31 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

30-Sept. 2 American Association for the Advancement of Science, Alaska Division, eleventh Alaskan science conference, Anchorage.

SEPTEMBER

6-7 Chemical Institute of Canada, organic chemistry division conference, Edmonton.

7-9 American Society of Mechanical Engineers, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass.

7-10 Billings Geological Society, annual field trip, Hebgen Lake-Madison Valley area of southwestern Montana.

8-9 National Research Council, Chemical Institute of Canada, tenth Canadian high polymer forum, Alpine Inn, Montreal.

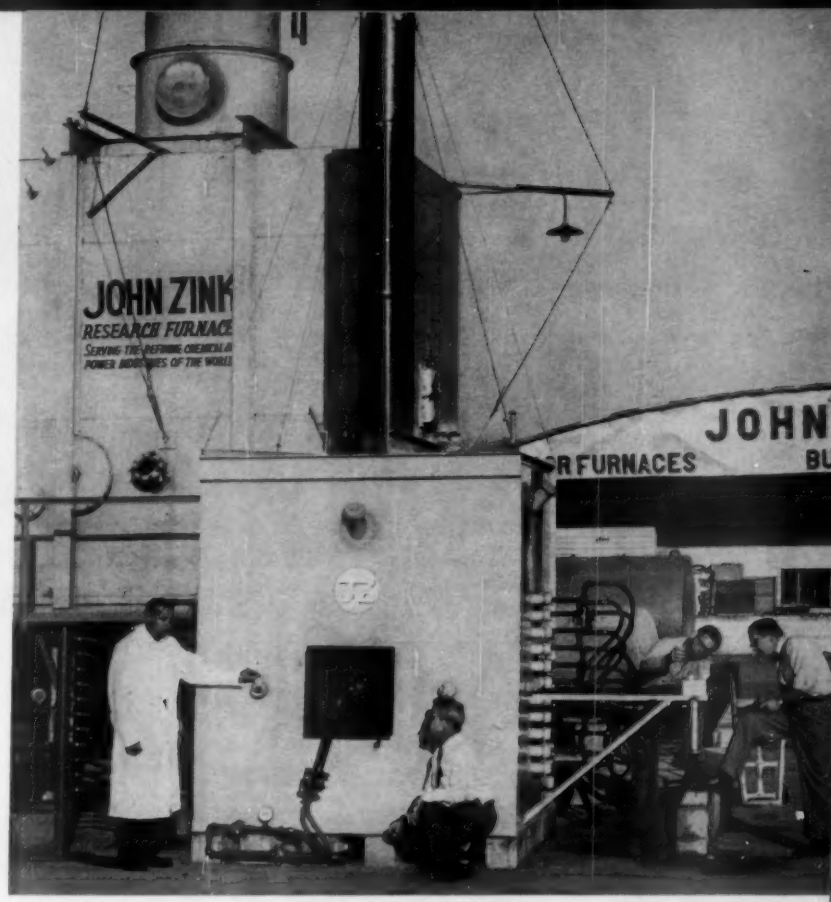
8-9 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

8-10 Chemical Institute of Canada, western regional conference, Regina.

8-10 Intermountain Association of Petroleum Geologists and Eastern Nevada Geological Society, field trip, economic geology of east-central Nevada.

11-16 American Chemical Society, national meeting, New York City.

14-15 Western Petroleum Refiners Association, Rocky Mountain regional tech-



A portion of the John Zink Combustion Research Center . . . the large furnace is used for studying flame characteristics and the smaller one for studying heat transfer phenomena.

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A: Call The JOHN ZINK Company

More than likely, John Zink engineers can give you an immediate answer, since this is one of the process industry's constant problems. As leaders in the combustion engineering field, they probably have encountered and solved this problem for furnaces and processes like yours.

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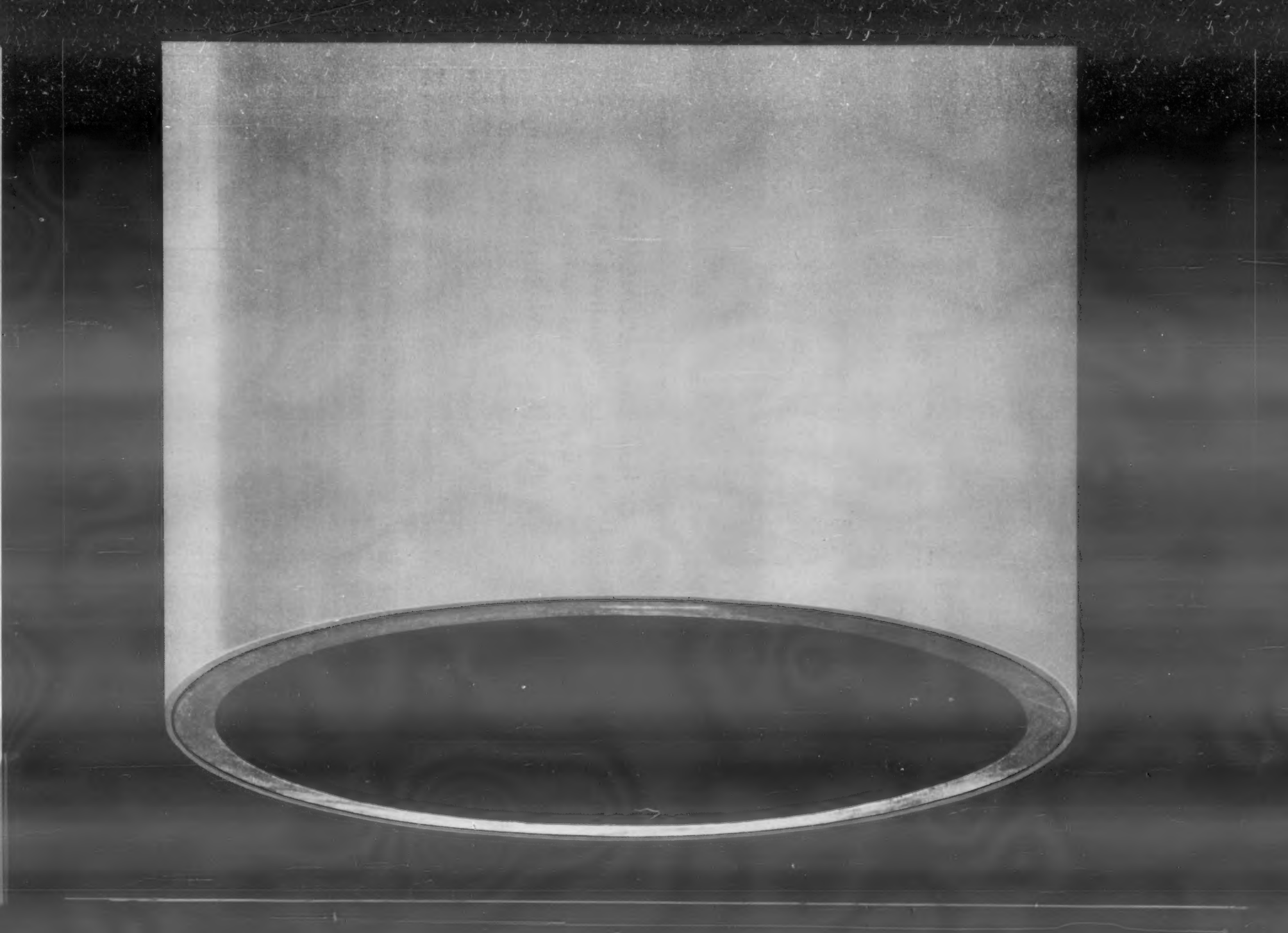

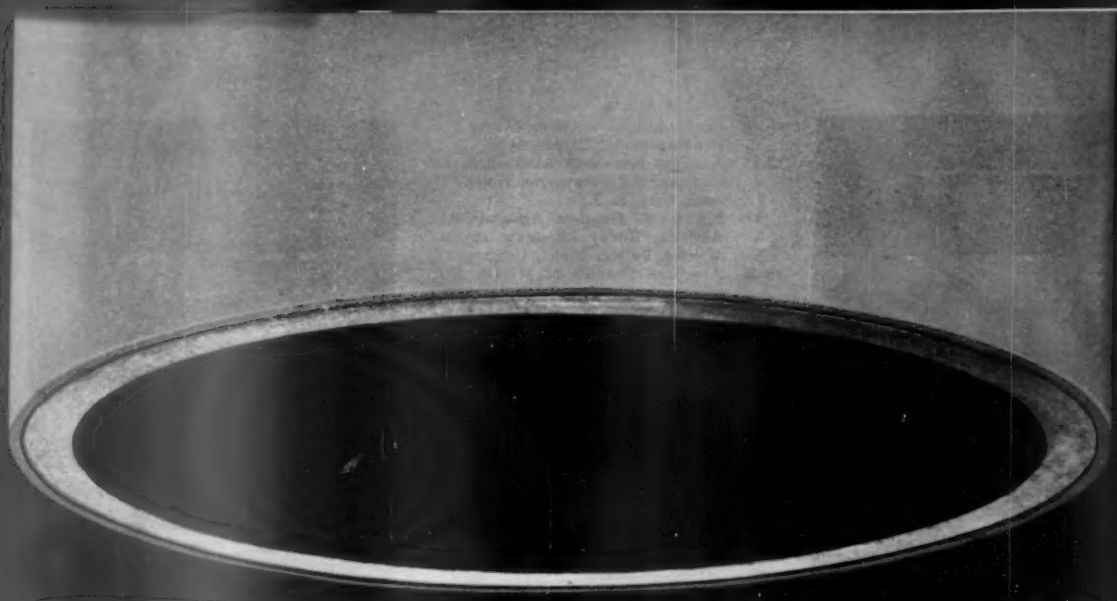

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14-16 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

15 Natural Gasoline Association of America, Rocky Mountain regional meeting, Palliser Hotel, Calgary.

15-16 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual engineering management conference, Morrison Hotel, Chicago.

18-21 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Jung Hotel, New Orleans.

19-21 Texas Mid-Continent Oil and Gas Association, annual meeting, Hilton Hotel, San Antonio, Tex.

21-23 Pacific Coast Gas Association, annual meeting, Westward Ho Hotel, Phoenix.

23 Oklahoma Utilities Association, gas division meeting, Biltmore Hotel, Oklahoma City.

25-27 American Association of Oilwell Drilling Contractors, annual meeting, Roosevelt Hotel, New Orleans.

25-28 American Institute of Chemical Engineers, meeting, Mayo Hotel, Tulsa.

25-28 American Institute of Electrical Engineers, petroleum industry committee, electrical conference of the petroleum industry, Hotel Skirvin, Oklahoma City.

26-29 American Welding Society, fall meeting, Penn-Sheraton Hotel, Pittsburgh.

26-30 Instrument Society of America, instrument-automation conference and exhibit, and fifteenth annual meeting, Coliseum, New York.

29-30 Mid-Continent Oil and Gas Association, Mississippi-Alabama division meeting, Grand Hotel, Point Clear, Ala.

OCTOBER

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton-Palace Hotel, San Francisco.

6-8 National Association of Corrosion Engineers, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Ga.

6-8 National Academy of Sciences, National Research Council, ninth national clay conference, Purdue University, Lafayette, Ind.

10-12 American Gas Association, annual convention, Atlantic City.

11-14 National Association of Corrosion Engineers, northeast region conference, Prichard Hotel, Huntington, W. Va.

12-14 Southwestern Federation of Geological Societies, annual meeting, Wooten Hotel, Abilene, Tex.

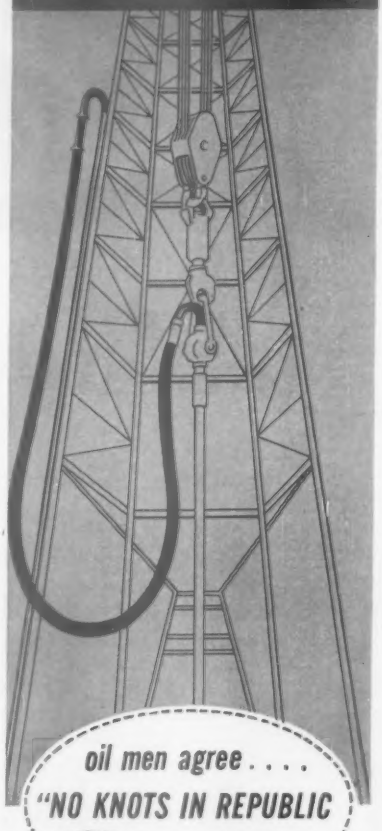
13-14 California Natural Gasoline Association, annual fall meeting, Hotel Miramar, Santa Monica, Calif.

13-16 Taft, Calif., Oildorado, fiftieth anniversary celebration.

17-19 American Society of Mechanical Engineers, American Society of Lubrication Engineers, lubrication conference, Statler Hilton Hotel, Boston.

17-19 University of Minnesota, Pennsylvania State University, Colorado School of Mines, biannual symposium on drilling and blasting, Golden, Colo.

REPUBLIC ROTARY HOSE



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the Journal said ...

50 years ago

June 16, 1910

British capital totaling more than $15,000,000 has been invested in California oil properties within the past 60 days. Major buying has been at Kern River, but has reached to Midway and Coalinga fields. Source of the capital still is not known but is rumored to be the Rothschilds.

Baton Rouge celebrates the arrival of Standard Oil Co.'s steamer Lucas, first ocean-going vessel to navigate the Mississippi River to this inland-Louisiana capital city. The tanker, towing two barges, is the first of Standard's fleet to serve this company's new refinery and pipeline terminal just north of town.

Hogshooter district south of Bartlesville, in Washington County, Oklahoma, still is supplying the best gas wells in the Mid-Continent region. Three of the last five wells completed are good for more than 20 M.M.c.f. of gas daily each.

25 years ago

June 6, 1935

Record drilling play sweeps Michigan following recent Dundee oil-pool discovery in Crystal Township in Montcalm County. More than 200 strings of tools are operating with number increasing. Development in Crystal pool spreads as wells come in with initial flows up to 3,500 bbl. daily from 3,200-ft. pay.

Agreement reached on long-considered unitization plan for Oklahoma's large South Burbank field in Osage County. Carter Oil Co. chosen operator under guidance of advisory committee. Project calls for return of produced gas to field's Burbank sand.

California's Oil Producers Agency gives up attempt to obtain passage of proration act it sponsored in state legislature. It will rely on continuation of production curtailment on a strictly voluntary and cooperative basis.

10 years ago

June 8, 1950

Supreme Court rules oil-bearing tidelands off the coasts of Texas and Louisiana are subject to paramount rights of federal Government. Both states plan steps to fight court decision. Industry fears administration of Gulf of Mexico operations may remain in doubt many years.

Pegasus, straddling the Midland-Upton county line, becomes West Texas' most active field despite the 13,000-ft. depth of its prolific Ellenburger production, and its $300,000 cost of wells. Field now has 10 completed wells and 25 drilling operations.

JOURNALLY SPEAKING

Worm's-Eye View

THE OTHER DAY we had a telephone call from an independent oil producer who excitedly and confidentially informed us that after prolonged study and personal investigation he had found the solution to the oil industry's problems.

If we would just pass it on to the industry, and, through the power of our editorial influence, induce all refiners and marketers to adopt it, everything would be hunky-dory.

His solution:

Raise the price of regular gasoline 2 cents per gallon.

His rationale was this: He had just returned from an extensive motor trip to Florida, during which he closely observed service-station practices and motorists' habits. He concluded that 90% of the motorists use regular gasoline rather than premium, but that practically all the gasoline price cutting is on the regular grade.

So he figured that if refiners and marketers would all raise the price of regular 2 cents and hold it there, and do their competitive price cutting only on their premium grades with their specially advertised additives, then they would all make enough money to pay producers like him a higher price for crude oil.

Now hear this one:

Within a week we had a visit with another independent producer who also had doped out the solution for the industry's generally profit-poor position. And he, also, was flattering enough to say that an editorial in our favorite oil publication would quickly swing the whole industry behind his plan.

His plan:

Raise the price of premium gasoline 5 cents a gallon and let the price cutters run the price of regular down as low as they want to.

His reasoning: The motoring public will respond to a vigorous advertising and merchandising campaign selling the virtues of premium gasoline with the various additives sponsored by the major refiners, plus the extra services (such as sweeping out floor mats) offered by quality service stations. Only transients, tourists, and a relatively few other price-conscious motorists who have no brand loyalty would continue to patronize the private-brand stations that slash the price of regular as a come-on to build volume. By ignoring price wars on regular and making a good profit on premium, refiners could afford to pay producers like him a higher price for crude oil.

There you have it—two diametrically opposite views on how to end gasoline price wars and bring prosperity to the whole industry.

Maybe you think that's funny, you people out on the actual firing line of gasoline marketing. Maybe you think that a producer, down there on the bottom rung of the oil-industry ladder, can have only a worm's-eye view of marketing.

But it's not all funny. Sure, these two producers are rather naive and unsophisticated to assume that it's as easy to raise prices as they say it would be. Both suggestions are oversimplifications, and an experienced marketer could poke a lot of holes in either one of them.

But each of these men has put his finger on a fundamental weakness in the oil business, namely, that the industry is dissipating its profits in gasoline price wars and if the marketing end of the business doesn't get on its feet the rest of the industry is going to suffer a lot more.

So it's a good thing to have producers worrying about marketing. For years they utterly ignored that end of the business and assumed that some refiner would come for their crude and offer a good price for it. Now they are realizing that if there are no profits at the motorist's tank there won't be any profits at the lease tank either. And they want something done about it.

Their worm's-eye view of marketing may not provide the cure, but certainly their diagnosis of the industry's troubles is on the beam.

And if enough producers come to realize that their fate depends on ending the chaos in marketing, perhaps in some way they can bring enough pressure some place to get things straightened out. The worm is turning in the right direction.

—Henry D. Ralph.

The weld you spread with a knife

Do you still weld shoes and collars to casing?

Bakerlok makes a stronger (and safer) joint -and at lower cost

Operators tell us that once you've used Bakerlok to lock shoes and collars to casing, you don't want to work without it.

Bakerlok makes a stronger casing joint than tack welding, and does it for a lot less money.

And note this: Bakerlok makes a safer joint, too. It doesn't weaken your casing as arc-welding sometimes does. Most operators are using Bakerlok on the strength of this point alone.

These are not mere claims. Thousands of successful field runs prove Bakerlok's success beyond any doubt whatever.

Why Baker Recommends Bakerlok

Bakerlok was developed to help operators get the best possible service out of Baker casing shoes and collars. Our interest is natural, since Baker is the world's largest manufacturer of shoes and collars. In Baker's opinion, arc-welding is not a satisfactory way to lock shoes and collars to casing. Bakerlok does everything welding does, does it faster, and does it without the harmful weakening effect of arc heat on high-grade steel casing.

Apply Bakerlok with putty knife to first ⅔ of pin threads only. 8 ounce can locks six 5½" joints.

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Bakerlok kit contains 8 ounce can of compound, activator, and putty knife. Kit is available at supply stores all across the country.

Get the important facts on Bakerlok from Baker Catalog Supplement 356. Write Baker Oil Tools, Inc., P. O. Box 2274, Los Angeles 54, California.

What's the role of price in conservation?

THE KANSAS CORPORATION COMMISSION has grabbed a legal hot potato by closing down 40 oil fields "to prevent economic waste" because the posted price is below the cost of replacing crude reserves.

If this action is upheld by the courts it will give state conservation bodies a new and powerful tool for regulation of the oil business.

It squarely poses a question that has been skirted gingerly for 30 years: Is the price of oil a factor in its conservation?

CONSERVATION LAWS of all states prohibit physical waste, but only a few specifically prohibit economic waste. And the term has never been defined.

But even though unmentioned or unmentionable, prevention of economic waste has been a motivating factor behind a great many conservation orders in various states, orders which were ostensibly bottomed on prevention of physical waste.

It is the rationale behind spacing and pooling orders to prevent drilling unnecessary wells; restrictions on use of natural gas for carbon black; allowable formulas that include depth brackets, stripper exemptions, and other economic factors; and proration to market demand.

Though later set aside on other grounds, minimum gas-price orders have been upheld as prevention of economic waste.

In other industries the prevention of economic waste underlies such measures as farm-commodity price supports, resale price-maintenance laws, and prohibitions against selling below cost.

The sociological concept behind this is that dissipation of capital and energy in unrewarding enterprises weakens the body politic. In oil conservation there is the additional justification that the economic waste of profitless production brings premature abandonment of present resources and lack of capital to develop new reserves.

So on both theoretical and practical grounds a case can be made for basing conservation orders on the prevention of economic waste—that is, to permit reasonably efficient operators to make a profit.

BUT DOES THIS CONCEPT justify a prohibition on selling oil or gas below replacement cost?

The industry has never faced up to the question of the price factor in conservation. It preaches the need for oil and gas prices high enough to encourage conservation, support continued exploration, and maintain a strong industry for national defense. But it denounces price controls and interference with free competition.

If this Kansas case is pursued to a showdown on its basic premise, the industry must prepare itself to do much soul-searching and to make some fundamental decisions on what is really embraced in conservation and just what is meant by economic waste in oil and gas production.

How to handle TEL susceptibility in linear programming of gasoline blending studies

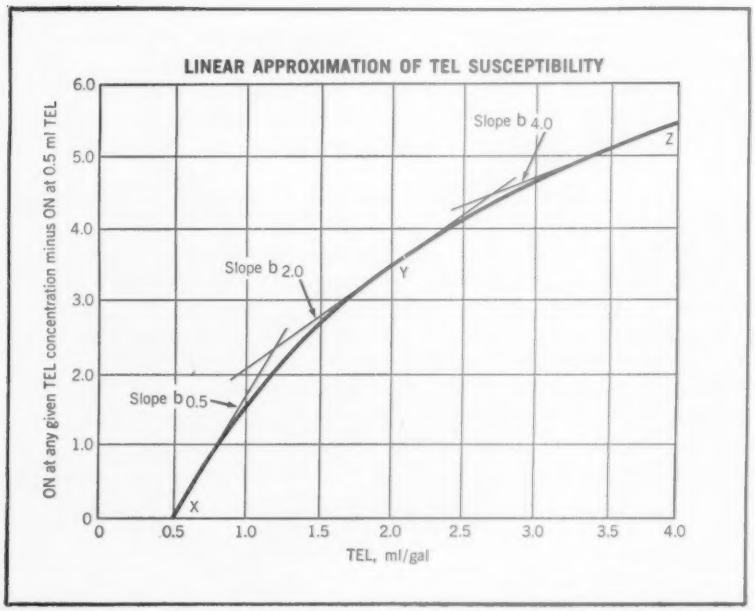
By Dr. W. C. Healy, Jr., Supervisor of the Computation and Economics Section, Refinery Technology Division, Ethyl Research Laboratories

In past years, gasoline blending was comparatively simple. An engineer could establish optimum blends for two grades of gasoline by using a slide rule and a TEL response chart.

Today gasoline blending and establishing maximum antiknock effectiveness are much more complex. Many components are used to make numerous grades of gasoline. Often, market conditions divert some gasoline component to another product. All this presents the refiner with a giant-sized problem of blending for maximum profit.

The magnitude of the problem has forced the refiner to electronic computer solutions, using such techniques as linear programming.

Because TEL susceptibility is a non-linear function, it presents a special problem for computer studies when linear programming is used. Many suggestions have been made for handling the TEL function, and one of the simplest recorded to date is outlined here.



The Ethyl method of handling the TEL function is similar to others in that a target TEL susceptibility curve is approximated by straight-line segments having fixed slopes. However, it is easier to use because—

A. No extra variables are introduced.

B. No extra upper-bounding conditions are required.

C. Set-up time is reduced.

Calculating TEL linear approximations is not difficult when final blend TEL susceptibility* is known. It becomes difficult when susceptibility is to be determined by computer. Calculations must employ approximated susceptibility values while retaining accuracy for reasonable deviations.

*TEL susceptibility is here defined as the difference between octane numbers at 4.0 ml. TEL/gallon and at 0.5 ml. TEL/gallon.

Here's How Ethyl's Method Works

For example, in the figure, three line segments are used to approximate the curve. The procedure is as follows:

A. Estimate a blend TEL susceptibility curve and then plot on rectangular coordinate paper.

B. Draw three approximating lines so that one line passes through point X (0.5, ON at 0.5), the second line passes through Y (2.0, ON at 2.0), and the third line passes through Z (4.0, ON at 4.0).

C. Determine the slopes of these approximating lines, $b_{0.5}$, $b_{2.0}$, and $b_{4.0}$, as shown on the accompanying chart.

Then the following inequalities are required; they state that the ml. TEL per gallon shall be no less than that required on any line segment, and no greater than 4.0.

$$1.\ TEL \geq \frac{ON\ (specification) - (ON\ at\ 0.5)}{b_{0.5}} + 0.5$$

$$2.\ TEL \geq \frac{ON\ (specification) - (ON\ at\ 2.0)}{b_{2.0}} + 2.0$$

$$3.\ TEL \geq \frac{ON\ (specification) - (ON\ at\ 4.0)}{b_{4.0}} + 4.0$$

$$4.\ TEL \leq 4.0$$

Let

$X_1, X_2 \cdots X_n$ = Barrels of each component in the blend.

ON_i at 0.5 = Corresponding octane blending values at 0.5 ml. TEL/gal.

ON_i at 2.0 = Corresponding octane blending values at 2.0 ml. TEL/gal.

ON_i at 4.0 = Corresponding octane blending values at 4.0 ml. TEL/gal.

And $Y = (TEL)(\Sigma X_i)$

Ther substitute in 1, 2 and 3 above

$$ON\ at\ 0.5 = \frac{\Sigma X_i\ (ON_i\ at\ 0.5)}{\Sigma X_i}$$

$$ON\ at\ 2.0 = \frac{\Sigma X_i\ (ON_i\ at\ 2.0)}{\Sigma X_i}$$

$$ON\ at\ 4.0 = \frac{\Sigma X_i\ (ON_i\ at\ 4.0)}{\Sigma X_i}$$

and multiply 4 by ΣX_i

These inequalities then reduce to the required linear expressions:

$$5.\ \Sigma X_i\ (ON\ spec - ON_i\ at\ 0.5 + 0.5\ b_{0.5}) - b_{0.5} Y \leq 0$$

$$6.\ \Sigma X_i\ (ON\ spec - ON_i\ at\ 2.0 + 2.0\ b_{2.0}) - b_{2.0} Y \leq 0$$

$$7.\ \Sigma X_i\ (ON\ spec - ON_i\ at\ 4.0 + 4.0\ b_{4.0}) - b_{4.0} Y \leq 0$$

$$8.\ Y - 4.0 \Sigma X_i \leq 0$$

Under certain conditions the number of inequalities may be reduced to three or less.

Susceptibility Changes Are Compensated

Error-compensation is a built-in feature with this method since, when blend susceptibility varies (higher or lower) from the estimated value, the line segments adjust themselves to the proper portion of the new curve.

For greater accuracy, more than three line segments may be used to approximate the susceptibility curve. This requires additional analogous inequalities, but no additional variables.

Each additional octane specification calls for an estimated susceptibility curve and the statement of inequalities as shown above.

Checking the program before the computer run.

How Ethyl Research can help you

Ethyl Research has several years' experience with linear programming as it applies to gasoline blending. This background has been especially valuable for customer service work.

The new method of handling tetraethyllead susceptibility is one example of the professional assistance available to the refiner from Ethyl.

In addition, the Computation and Economics Section in our Refinery Technology Division will be glad to share its experience in computation techniques with your people.

For further information, ask your Ethyl Representative for a copy of "Two Approximation Problems in Linear Programming of Gasoline Blending" presented at the Computer Conference of the WPRA in Tulsa, December 1, 1959. He'll also be glad to arrange an appointment for you with one of our Mathematical Analysts.

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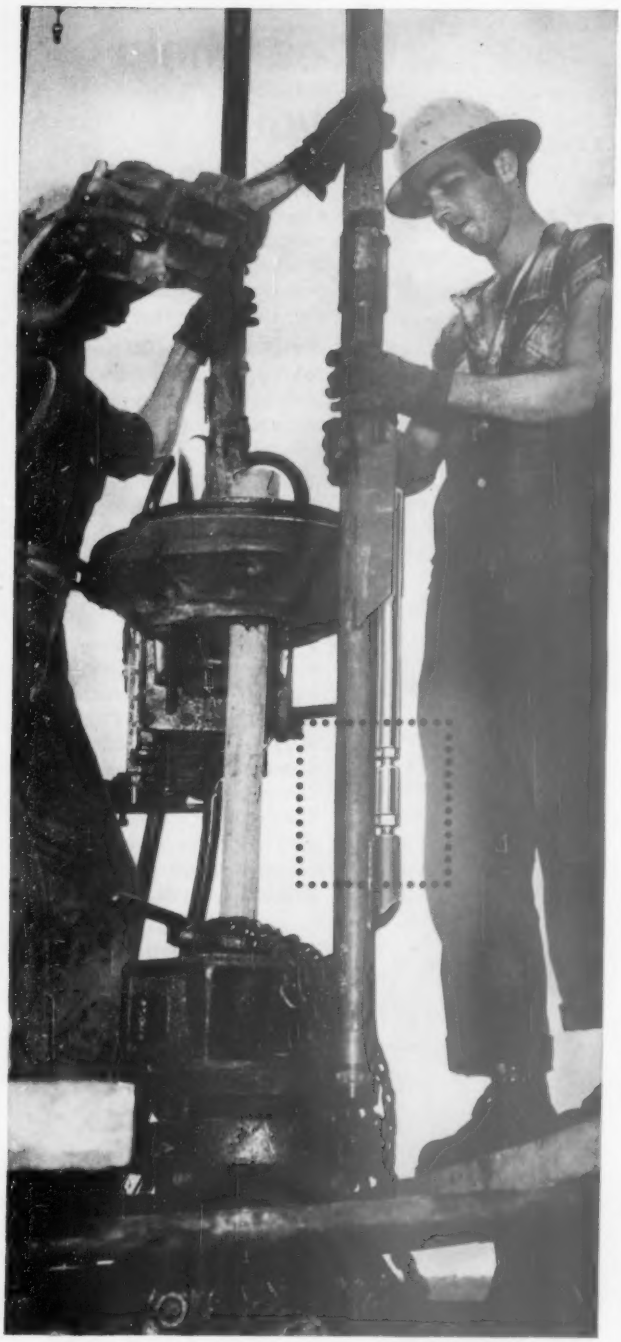
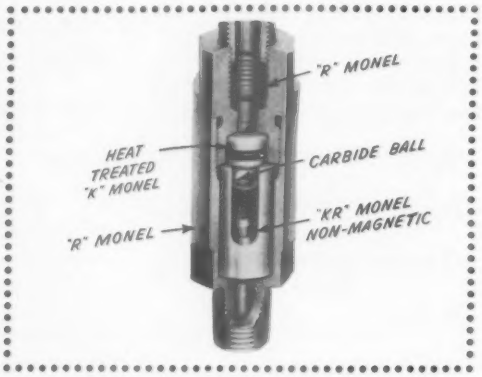


When gravity check valves cannot be used with gas lift valves, a new magnetic cage and ball check valve made by Harold Brown Company of Houston, Texas may be an easy solution to the problem. The new valve is extremely reliable in preventing back flow, thus reducing erosion of critical valve parts and giving the installation longer life.



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Outside casing is made of Monel* nickel-copper alloy because of its strength and resistance to attack by hydrogen sulfide, brines and carbonates.

Body and seat of "R" Monel* free-machining nickel-copper alloy. This alloy was selected due to its corrosion resistance and the ease of producing threads in it with automatic screw machinery.

Insert seat is of "K" Monel* age-hardenable nickel-copper alloy. It is heat-treated before finishing, producing a corrosion-resistant material with extra strength, hardness, and non-magnetic properties.

Ball cage is made of "KR" Monel* machining-grade age-hardenable nickel-copper alloy. The ease with which it is machined in automatic machinery enables rapid production of parts. It is heat-treated before finishing to yield a corrosion-resistant non-magnetic material, with high strength and hardness.

For more information on these alloys write for a copy of "Metals to make petroleum production equipment produce more."

*Inco trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
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MONEL® ALLOYS

Tidelands Decision Leaves Some Big Questions Unanswered

• Louisiana, for example, won't know for months, and maybe years, just how much oil land it will control. With only a 3-mile strip from the "coastline," it still could wind up with more acreage than Texas, with 10½ miles.

THE BIG question—particularly for Louisiana—that the U. S. Supreme Court left unsettled last week was the starting point a Gulf Coast state must use in measuring its submerged lands.

The court was specific on how far each state will measure. For Texas, it will be 3 leagues (10.5 miles) seaward from its coast. The same will apply for the west coast of Florida. Louisiana, Alabama, and Mississippi, however, were allowed only 3 miles.

But the court didn't define a coastline, so the states still don't know just where their submerged land boundaries lie.

It may be years before they all find out.

Louisiana has by far the biggest stake in the settlement of the issue because there is a much greater discrepancy in its claims and the claims of the federal Government than is the case of the other states.

There are two principal reasons for this:

First, Louisiana has such an irregular shore line—an almost indistinguishable one along some of its marshy lands.

Second, it is claiming that its coast line is a line established by the U. S. Coast Guard in 1895. This line is far from shore. In some places as far as 25 miles.

Where to start? . . . Although the supreme court has ruled that Louisiana is entitled to only 3 miles and not 3 leagues, it has not ruled out the Coast Guard line as the starting point for measuring the 3 miles.

"We decide now only that Louisiana is entitled to submerged land rights to a distance no greater than 3 miles from its coastlines, wherever those lines may ultimately be shown to be," the court majority said.

Highlights of Court's Rulings

- Texas is entitled to the lands, minerals, and other natural resources underlying the Gulf of Mexico to a distance to 3 leagues from its coast, "that is, from the line of ordinary low-water mark and outer limit of inland waters."
- The same applies to Florida, on its Gulf Coast side.
- Louisiana, Alabama, and Mississippi are entitled to "3 geographic miles from the coast of each state." (As with Texas, this is specified as the ordinary low-water mark and outer limit of inland waters.)
- The court retains jurisdiction in all the above cases until the exact boundaries and other matters are settled.
- The states are directed to "account to the United States for all sums of money derived since June 5, 1950, from the area to which the United States is declared entitled."

SOME OFFSHORE FACTS:

- **Money held in escrow as of March 31**
  $308,443,176
- **Offshore leases let (total 391)**
  La. 349; Fla. 23; Texas 19
- **Offshore holes drilled (total 2,264)**
  Off Louisiana 2,233; off Texas 31
- **Producing wells**
  Off Louisiana 1,558; off Texas 6
- **Cumulative production**
  Louisiana 112,937,270 bbl. crude, 790,970,241 M.c.f. gas. Texas 21,229 bbl. crude, 4,800 M.c.f. gas.
- **Value of production**
  Louisiana $385,647,564. Texas $66,533.

If the court should eventually approve of the Coast Guard line as the starting point, the state would wind up with all of Zone 1, most of Zone 2, and a considerable part of Zone 3.

It may be, of course, that the court will adopt the Chapman line, which roughly follows the shore line, or some similar line much closer to shore than the Coast Guard line the state claims.

In that case, Louisiana would lose all claim to Zones 2 and 3.

Actually, the state would be better off with the 3-mile limit if the old Coast Guard line were used as the starting point than it would have been under a 3-league limit if the 3 leagues were to be measured from the shoreline.

The significance of what is hanging in the balance in the starting-point issue can be illustrated by 1959 production figures from the disputed Zones 2 and 3; crude, 28,635,980 bbl.; condensate 1,749,362 bbl.; casinghead gas, 28,573,468 M.c.f.; natural gas, 173,507,538 M.c.f.

Too, the state would lose the bonus money paid for the leases in Zones 2 and 3, plus the royalties which have piled up in escrow while the tidelands battle was being fought.

(For all offshore lands in the Gulf of Mexico, the amount of bonus and royalty payments held in escrow totaled $308,443,176 as of March 31, the Interior Department reported in Washington last week.)

It is obvious, therefore, the high stakes Louisiana now has in the determination of the starting point for measuring its submerged lands.

No problem elsewhere . . . The issue of a coastline is not so important to the other states because their shorelines are more regular and because the others have not sought to establish claim to the equivalent of Louisiana's "Coast Guard" line.

Even so, each state obviously will seek to have a coastline established as far seaward as possible in order to extend its submerged-lands boundary. A few hundred feet or so could be highly valuable if large quantities of oil or gas were discovered in that particular spot.

Although the court did not specify what its procedure will be to determine the coastline for any of the states, there was speculation in Washington that it would probably set up a master's court—at least for Louisiana—to make recommendations. This was the procedure used in the California boundary dispute.

If this is done, the work of a joint federal-state committee, which has been seeking to map out a clearly defined shoreline, would be important.

This six-man committee is strictly advisory, but it no doubt will be called on for the information it has gained through its study.

It is understood that the committee already has pretty well determined about 70% of the shoreline because the point at which land meets water is fairly stable and definable along parts of the Louisiana Coast.

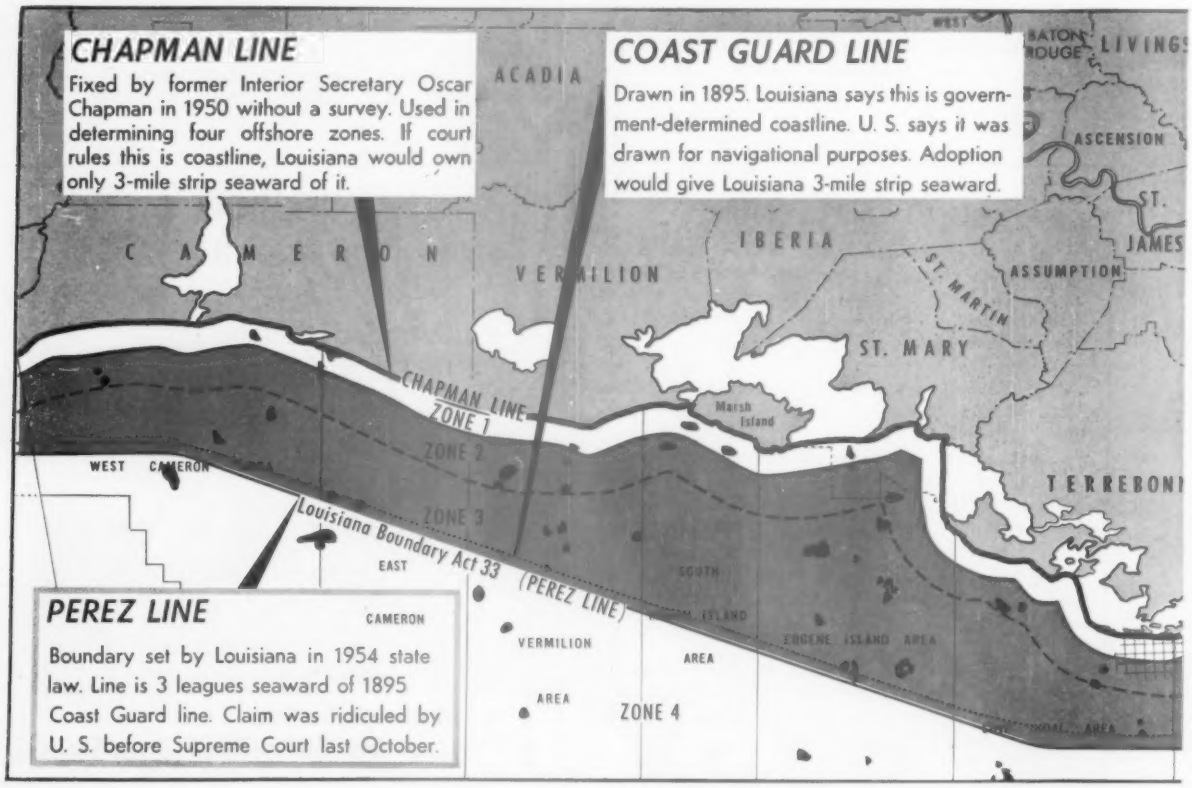
The difficulty lies in Mississippi Delta and the Atchafalaya Bay area where the shoreline is extremely ragged and is undergoing constant change.

Texas' situation . . . For Texas the decision cleared title to 1,769,990 acres of offshore areas.

It brought such enthusiasm that the Texas Land Board disclosed it will hold an "early meeting" to discuss plans for a sale of offshore leases. Members indicated the first sale could come early this autumn.

Settlement of the dispute has little effect on ownership of most of the state's offshore fields. With few exceptions, Texas' offshore fields are so located that there is little or no question of ownership, regardless of any future dispute over the coastline.

Texas' waters have been far less attractive than Louisiana's, and there's been much less exploration. So far only 11 fields have been found strictly


CHAPMAN LINE
Fixed by former Interior Secretary Oscar Chapman in 1950 without a survey. Used in determining four offshore zones. If court rules this is coastline, Louisiana would own only 3-mile strip seaward of it.
COAST GUARD LINE
Drawn in 1895. Louisiana says this is government-determined coastline. U. S. says it was drawn for navigational purposes. Adoption would give Louisiana 3-mile strip seaward.
ACADIA
CAMERON
VERMILION
IBERIA
ST. MARTIN
ASSUMPTION
ST. MARY
ASCENSION
ST. JAMES
BATON ROUGE
LIVINGS
TERREBONI
CHAPMAN LINE
ZONE 1
ZONE 2
ZONE 3
ZONE 4
Marsh Island
WEST CAMERON
Louisiana Boundary Act 33 (PEREZ LINE)
EAST CAMERON AREA
SOUTH EUGENE ISLAND AREA
VERMILION AREA
EUGENE ISLAND AREA
PEREZ LINE
Boundary set by Louisiana in 1954 state law. Line is 3 leagues seaward of 1895 Coast Guard line. Claim was ridiculed by U. S. before Supreme Court last October.

offshore, compared with Louisiana's 125.

Seven of the 11 are within 3 miles of land. One is just 8 miles out. The other four fields are well beyond the 10½-mile limit, from 12 to 20 miles out in the gulf and obviously in the federal area.

New hearings . . . The problem in Louisiana may be made even tougher by state officials who, angered over the court's action in cutting their 3-league claim to 3 miles, will probably make a bitter fight for every inch of submerged land they can get.

However, before the court proceeds toward determining a state's "coastline," it will no doubt rule on requests for rehearings that Louisiana, Mississippi, and Alabama are expected to make.

Should the court grant such rehearings, this would mean further delay in settling the coastline issue.

Obviously, complete settlement of the sumberged lands is many, many months away—perhaps years.

And it is just as obvious that state-federal relationships in the submerged lands operations will be under greater strain, both before and after final settlement.

Change in proration? . . . Louisiana quite likely will be less cooperative than in the past, now that the Supreme Court has "robbed" it of 7.5 miles of valuable submerged lands.

Thus far, since the federal Government has given it operational jurisdiction over submerged lands off its coast, it has sought to encourage offshore production.

But if the Supreme Court's ruling sticks, the state may tighten down on offshore allowables, well spacing, and other matters affecting the production there. Certainly, it would not encourage a flood of "federal" crude oil when its own state allowables were being trimmed.

In such a situation, the federal Government might in turn seek to be more demanding. There have already been hints that federal officials are considering the possibility of establishing their own rules for offshore production within their jurisdiction (OGJ, Feb. 22, p. 64).

Offshore operators could get hurt in the tug-of-war between state and federal governments.

Conceivably, the Supreme Court may also get involved in this struggle, for in its ruling last week it said that it would retain jurisdiction over the tidelands case "for such further proceedings as may be necessary to effectuate the rights adjudicated herein."

It may be that the court had in mind only the problem of establishing a specific boundary, but the wording of its decree did not limit it to that alone.

The decisions . . . It is clear that the court pondered long over its decisions in the submerged land case.

It filed two opinions. One concerned Texas, Louisiana, Alabama, and Mississippi. The other applied to Florida alone.

Chief Justice Earl Warren and Justice Tom Clark disqualified themselves from both because each had been involved in the tidelands issue while serving as a state official.

In the decision affecting the four states, the court divided, 5-2. The majority's opinion ran 81 pages—unusually long for a court decision. Justice Douglas wrote a 19-page dissent. Justice Hugo Black also dissented in part—for 17 pages—contending that Louisiana, Mississippi and Alabama should get 3 leagues as well as Texas.

In the majority's opinion, it was emphasized that Texas and Florida won a 3-league ruling while the others were held to 3 miles because those two states were able to offer convincing evidence that they had established historical rights to a 3-league boundary.

The strong point for Texas was that while it was an independent nation it claimed a 3-league boundary and that it was annexed by the United States under a provision that awarded it the boundaries it had while a nation. (The federal Government had argued that the Texas claim of 3 leagues while it was independent was not recognized by any other nation.)

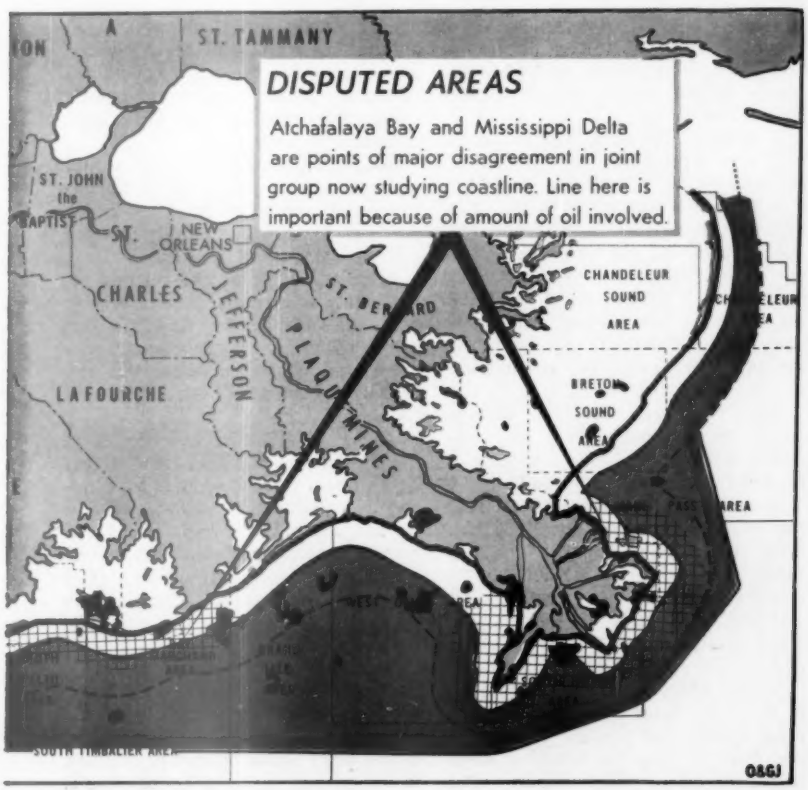
The clincher for Texas, as the court majority saw it, was the 1848 treaty of Guadalupe-Hidalgo between the U. S. and Mexico in which the Texas boundary was defined as extending 3 leagues into the sea.

The strong point for Florida was that Congress had specifically approved—in 1868—a 3-league Gulf Coast boundary for that state when it was readmitted to the union.

Unfortunately for them, the other three states could not point to such specific proof—at least not in the eyes of the court. They had to rely largely on treaties made between nations before their territories became a part of the United States.

The court's conclusion was that the U. S. had never recognized a 3-league boundary for them as it had for Texas and Florida.

The decision was the court's first major step toward solving the dispute. The next will come when it defines the "coastline" and the states can finally determine their ownership.



Kansas May Set New Signposts in Conservation

• Court action is expected over Kansas' unusual order in shutting down oil fields to prevent price deterioration, and its refusal to rehear the case. Producers say they can outwait Derby, and they're looking for other buyers.

THE WAY now has been cleared in Kansas for a possible court battle over a Corporation Commission order halting production in 40 Central Kansas pools to prevent a price cut.

The shut-in order became effective last week for 544 wells in Sedgwick and Sumner counties amid these other developments:

... **A rehearing** of the shut-in order was refused by the commission.

Derby Refining Co., Wichita, sought the reopener. Its 20-cent price cut on May 16 set off the series of events leading to the shut-in order.

... **Producers in the idle fields** scouted far and wide for new buyers of their 6,000 bbl. daily of crude.

They hope to find a market soon for all the oil. Derby has been the lone buyer, using the crude in its Wichita refinery.

... **Legal issues** arising from the case interested oil and gas lawyers throughout the industry with possibility that implications of the case could spread far and wide.

Next move . . . Derby's next legal move lay in Kansas district court.

The refiner exhausted its administrative remedy when the commission refused to delay the shut-in order and rehear the case. But Derby officials withheld an immediate move into district court.

Derby's petition before the commission for a rehearing claimed the shut-in order was:

... **An attempt to fix prices** rather than to correct economic waste. It cited a 1949 Kansas conservation statute as saying "nothing contained is intended to vest the commission with authority to fix the price of crude oil."

... **Beyond the scope** of the agenda of the commission hearing. The hearing had been called to determine "market demand only" and not the matter of economic waste.

... **Arbitrary and discriminatory** since it was directed at Derby as a means of compelling the purchase of crude at a price desired by "certain producers."

.. **Damaging** to those producers who wished to produce and sell to Derby at prices offered.

... **Not substantiated** by sufficient data at the hearing showing economic or physical waste in the affected pools.

W. C. Norman, president of Colorado Oil & Gas Corp., the parent company of Derby, also charged in a separate statement that the commission acted on the request of a "few producers" and the validity of the order was questionable since Derby did not take part in the hearing.

The commission in turning down Derby's petition held that the company had been notified of the hearing and that Derby representatives present had offered no objections as the producers put on evidence for the record.

Norman indicated later an appeal of the commission order into Kansas district court was under consideration but action awaited a decision of counsel.

He reiterated the petition for a rehearing was made "in the hope that we would be permitted to be heard in this unfortunate situation. We had not been given sufficient notice of the hearing on which this order was based."

Producers busy . . . The producers also were busy trying to win both public opinion and a new outlet for their crude.

J. Robert Martin, a Wichita attorney who represented the producers, declared Derby is trying to build up a case in the public mind that the order was directed at it in discrimination. Martin said this wasn't true, adding: "The producers simply couldn't afford to sell their crude at the price the company was paying. The company is the monopoly purchaser, so the producers asked the commission to shut down their wells."

The producers, led by George Bruce, Wichita independent, also contacted other crude buyers seeking a market for the 6,000 bbl. daily.

At midweek, Martin announced that buyers had been found for 3,800 bbl. daily at a price of $3.05, which was Derby's price prior to the cut. Martin described this as a permanent market and said the crude would start moving when details, such as division orders and pipeline routing, were worked out.

Martin added the producers planned to move the crude over Derby's gathering system and pipeline and would not have to pay for trucking costs to get the oil to market. He said that the independents had prospects of finding a home for all the shut-in production.

One major reportedly backed away from buying the oil because of antitrust aspects. It feared that buying might be interpreted as an attempt to hold up the price of crude. Economics also was against the producer in this particular deal because the netback would have been less than the reduced Derby price because of extra transportation charges.

Another buyer reportedly could find a market for the shut-in crude but only at distress prices of about 40 cents a barrel under the $3.05 price the producers are seeking to hold.

Derby has the only pipeline into the two counties, and the oil moves

There's Little

THE ACTION of the Kansas Corporation Commission in declaring that a low price for crude oil constitutes "economic waste" under the state's conservation statute has little legal precedent behind it.

But such precedent as exists would seem to support the action as a constitutional exercise of the state's police power to protect the natural resources and the economy of Kansas.

A quick check of the records reveals only one similar case involving crude oil—in Oklahoma in 1914. But setting minimum prices for natural gas to prevent economic waste was upheld by the courts in both Kansas and Oklahoma.

The 1914 oil order was applied in the Cushing field at the height of that field's boom when there was tremendous overproduction, above-ground storage, and physical waste. The Oklahoma Corporation Commission had no standard for proration other than price, and it based its action on the state's general police powers plus antitrust and common-carrier statutes as applied to pipeline-purchasers.

The OCC concluded that it could not issue an order preventing purchasers from paying less than a particular price unless oil can be retained in the ground until market conditions

over a short haul into the Wichita refinery.

Meanwhile, the Wellington waterflood area, producing about 1,800 bbl. daily from 139 wells, has been exempted from the shutdown. Cooperative Refinery Association, owner of the production, asked and received permission to continue buying its own oil through the Derby pipeline.

Tom Schwinn, executive vice president of Kansas Independent Oil and Gas Association, who has been supporting the protesting producers, said he felt producers can hold out longer than Derby can. He estimated Derby has about 15 to 20 days' supply of crude on hand.

Schwinn added that producers mind the loss of income but they don't want to deplete their reserves for prices lower than replacement costs.

Schwinn was asked what will producers do who have notes coming due at the bank, production payments to make, or continuous-production clauses in their contracts.

He said these problems were being worked out, indicating temporary moratoria were being arranged on the basis of underages granted by the commission. The producers thus will be able to make up any lost production later.

Calming influence . . . Both sides in the controversy thus far have avoided inflammatory positions.

Derby at the time it posted its 20-cent cut from a top of $3.05 to $2.85 declared it was reluctant to make the move. It did so only after a first-quarter loss caused by low product prices. The company received only $3.83 per barrel for products in that period compared with $4.33 per barrel in the same period last year.

Schwinn declared the producers aren't seeking punitive action either, only trying to protect their price structure. He said that was the feeling which prompted producers to drop earlier plans for a producer boycott of Derby.

Two producer organizations had announced that a telegram would be sent urging producers outside the 40 fields also to shut in their wells rather than to sell to Derby. The telegram, however, was held up indefinitely pending further study.

One heartening sign appeared on the scene during the week: An attempt by several Mid-Continent refiners to increase the price of gasoline by ½ cent per gallon in territory served by the Great Lakes Pipeline. If this move prevails, it would mean about a 20-cent per barrel jump in refinery income and might lead to a compromise in the Derby-producer battle.

Legal issues . . . A court test of the case could bring out many interesting legal angles, and the trouble already has oil industry lawyers checking their law books.

Many lawyers feel the case at this stage has two key issues: Discrimination and economic waste. Some see a good possibility that discrimination may become the overriding issue, permitting economic waste to go untested.

Economic waste is provided by Kansas statute, and the commission used it as the reason for shutting in production. The commission reasoned that sale of oil at the Derby price would not cover cost of finding, producing, and replacing the crude; that exploration, development, and production would therefore be impaired, and that known sources of oil would be liquidated without being replaced.

The lawyers feel a court test would be important to other oil states.

Precedent Behind Kansas' Economic-Waste Rule

justify its production, but it ordered that "all producers shall not take more oil from their wells than can be sold upon the market at 65 cents per barrel."

This order was never contested in court, and apparently the outbreak of World War I in Europe soon took care of the surplus and price problems. However, in 1915 the Oklahoma legislature passed a law specifically empowering the commission to set minimum prices for oil. No orders were ever issued.

Statute provisions . . . Conservation and related statutes enacted in the early 1930's by both Oklahoma and Kansas specifically prohibit economic waste or production in excess of reasonable market demand. There is some thought that the word "reasonable" could be interpreted to mean a market at a price which the producers consider reasonable, but this suggestion has never been tested.

However, the "economic waste" provisions were applied to gas successfully by both states.

The first arose in the Oklahoma portion of Hugoton field in 1945 out of a dispute between Peerless Oil & Gas Co. and Cities Service Gas Co. As a part of its field-wide spacing and proration order, the Oklahoma Commission required a producer seeking a pipeline connection to tender gas at the going field price. The parties disputed whether the going price was 4 or 4½ cents per M.c.f.

The commission instituted a general investigation and set a field-wide minimum price of 7 cents, saying that anything less than that constituted both physical and economic waste.

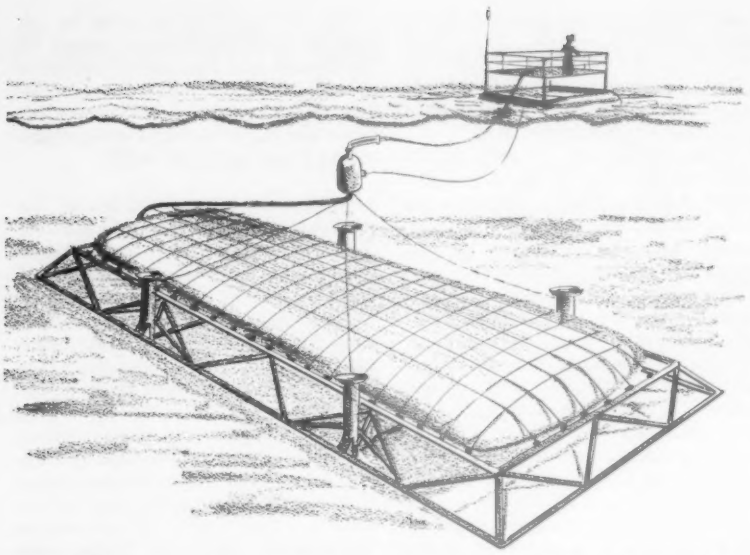
This Peerless case was upheld by the Oklahoma Supreme Court, and, in December 1950, by the Supreme Court of the United States. The high court held the order valid even as to gas moving in interstate commerce, saying that the producing state could, in conservation of its natural resources, establish a minimum wellhead price although it had an impact on interstate commerce.

Kansas pricing . . . Following the same reasoning, the Kansas Supreme Court in 1950 upheld an order of the Kansas Corporation Commission setting a minimum price of 8 cents per M.c.f. for production in Kansas portion of the three state Hugoton field.

Later both these minimum-price orders were nullified by the Federal Power Commission which held that the Supreme Court's decision in the Peerless-Cities Service case was on narrow grounds of conservation only and was not intended to interfere with the federal power to regulate producers' gas prices under the Phillips decision. This FPC decision was upheld by the Circuit Court of Appeals.

During the early 1930's when the Interstate Oil Compact was being drafted and many states were pioneering in writing conservation laws, there was much discussion over a state's power to use minimum prices as a conservation tool, and whether price was the proper standard for judging market demand. At that time Oklahoma and Kansas held out vigorously for price control, but most other states made no mention of price or economic waste in their statutes, even when requiring proration according to market demand.

At one time, when East Texas and Oklahoma City fields were flush and oil was selling for 25 cents a barrel or less, the governors of Texas and Oklahoma simultaneously called out the militia and shut down production by martial law with the announced intention of raising the price to $1 per barrel. This action did get the price up, but its legality has always been considered rather shaky.



PROTOTYPE for an underwater fuel cache is anchored by pilings, harnessed to a metal frame by nylon, and connected to a surface float by a rubber hose.

Storage Offshore?

Put it in a bag

THE OIL INDUSTRY, by courtesy of the U. S. Navy, shortly will see the first real test of underwater storage of a petroleum product in a rubber bag.

If the test succeeds, it could point the way to many offshore uses.

Fares Hanna, a Houston engineer and contractor, foresees the day when the bags will be used:

. . . **By the Navy** to store fuel at secret points around the world.

. . . **By producers** to store crude in deeper waters offshore.

. . . **By drillers** to store fresh water, mud, diesel fuel, and other liquids for operations.

The advantages, according to Hanna, are many. The bags, under certain conditions, are cheaper than conventional offshore storage; they're safe from surface storms; they're not navigational hazards; and they're comparatively easy to install, operate, and maintain.

The test . . . The first application of the theory is a modest one.

The U. S. Navy has contracted with U. S. Rubber Co. to install a 1,200-bbl. bag in about 50 ft. of water in Block 37, Grand Isle, off Louisiana. The work will be done the week of June 15. Diesel fuel will be pumped into the bag and extracted, as needed, by Navy or Coast Guard vessels operating in the area.

Hanna is designer of the storage system, which is designated an "underwater fuel cache."

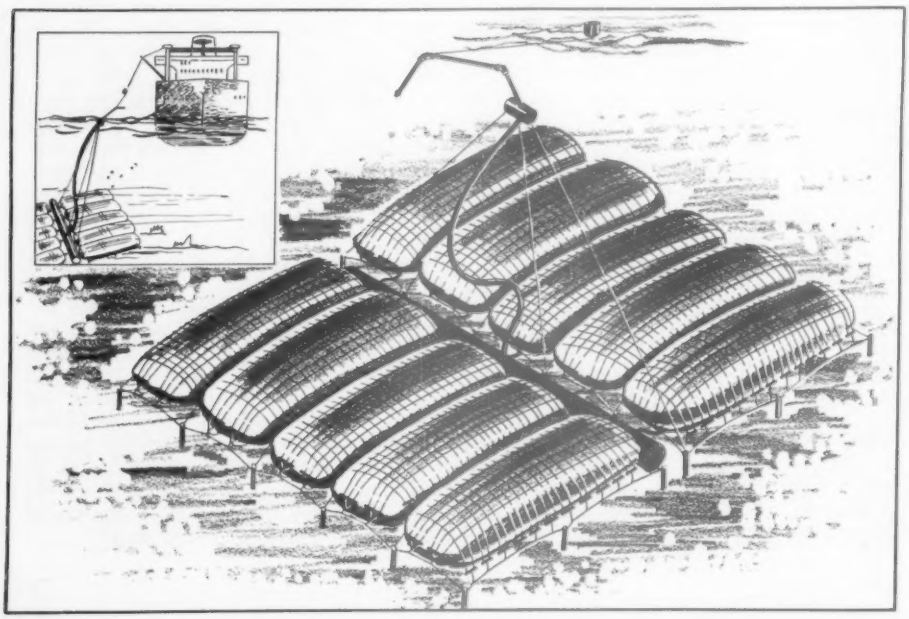
Already U. S. Rubber and Hanna are working on a plan to tie together 20 such bags for a 25,000-bbl. installation. The size of the bags also may be doubled to 2,500-bbl. capacity each.

Also down the road is a possible Navy plan for a 100,000-bbl. storage system to handle a variety of fuels at a single installation off the West Coast.

The installation . . . The storage system to be used off Louisiana will consist basically of a rectangular rubber bag harnessed by nylon webbing and affixed to a pile-driven frame (drawing).

On the surface will be a 14-ft.-square anchored float, to which the refueling vessel will tie itself. A rubber flow line will extend to a submerged swivel buoy located below the water line and directly above the storage bag. The buoy will be held in place by four cables tied to the piling.

The flow line then extends to the rubber bag which, when full, will



ALREADY planned is an effort to tie together 20 bags for a 25,000-bbl. installation. Size of bags may be doubled to 2,500-bbl. capacity each, and down the road is a Navy plan for a 100,000-bbl. storage system.

measure 68 by 17 ft., and be 6 ft. thick.

The framework serves not only to anchor the bag but also to keep it 5 ft. above the mudline to prevent deterioration resulting from contact with the ocean bottom.

Fuel can be pumped into the bag at the rate of 840 g.p.m. Hydrostatic pressure will move the fuel out.

Water depth . . . Compared with conventional offshore storage in metal tanks, the rubber-bag method would tend to become more economic as the water depth increases.

In shallow waters the cost of erecting a storage platform is much less than in deep water, while the float-and-bag system would tend to have a fixed cost that would change little with water depth.

Hanna believes it is practical in water depths to 150 or 200 ft.—any depth at which divers can operate. Likewise, he says, it should be economic in shallow swamp waters.

If used by drilling operators in the deeper waters, it could reduce the size of mobile drilling units which currently must provide space for fresh water, mud, and fuel.

Also the method would be advantageous, according to Hanna, for storing crude in deeper waters until lines are laid.

New gimmick . . . The Navy currently is financing a project which greatly increases the potential value of underwater storage in rubber bags.

It involves the use of two-stage rockets to shoot anchors into the ocean bottom.

If current testing of the method proves successful, bags could be anchored at virtually any depth—and at a cost far less than pile driving.

The Navy's prime interest in underwater storage, Hanna says, is to be able to install it in any waters on earth in such a way that it would not be detected from the surface. The method must be simple and the equipment easy to transport.

By rocketing anchors into the ocean bottom, suspending the rubber bag at any desired distance above the bottom, and placing a floating buoy nearer the surface, the Navy could refuel secretly at such points during emergencies.

Two companies currently are working on the rocket system, according to Hanna.

The direct value to the oil industry from such a development would be to increase the depth at which storage of crude, products, or other materials is possible. Serious drilling in depths greater than 200 ft. is expected in the immediate years ahead.

watching WASHINGTON

Clyde La Motte

• Residual: Weak spot of import controls . . .

THE INTERIOR Department has just gone through the throes of setting import quotas for a new allocation period (page 80). And, once again, most of the agony was over the problem of residual fuel oil.

There are two reasons why residual is the knottiest of the import problems: Politics, and the fact that quotas are tied to demand forecasts.

Either factor alone is bad enough, and combining them really fouls up the situation.

For instance, last December when the January-June quotas were being set, the Bureau of Mines made its forecasts on residual demand. Like most oil forecasts being made at that time, it tended to be a mite optimistic.

The bureau's forecast was trimmed some by Matthew V. Carson, the imports administrator, and trimmed still further by Interior Under Secretary Elmer Bennett. As it turned out, a little too much was trimmed, necessitating a hike a few weeks back.

This time, for the July-September period, the bureau tended to be more conservative. Carson and Bennett apparently were, too, judging from the results.

Furthermore, there must have been more factors involved than the demand forecast and stock figures to have brought on the drastic cutback which Interior ordered. One such factor, unfortunately, may have been politics. Certainly there were enough delegations, chiefly from the coal industry, calling on import officials.

• Problem: How to free "captive" firms . . .

ANOTHER CHRONIC sore spot of the resid program stems from its "frozen" nature. Companies such as Gulf Oil Corp. are highly unhappy over the fact that residual allocations are tied to the amount a company imported during the base year. This means that those few companies who had a high record of imports during the base year have it good now while the others are caught short.

There has also been considerable friction from this situation: Before controls were instituted, some importers were letting their customers be the importer of record while other importers were bringing in resid under their own name.

As a result, if a wholesaler was the importer of record, he now has the import quota. If not, then the importing company is the one eligible for a quota under the control program.

This has led to charges of "captive customer" and "captive supplier."

Wholesalers without quotas complain that they can't shop around for their supplies as in the past because they are tied to their importer who has the quota. Some have charged that their supplier sells to them at posted prices while selling at below posted prices to wholesalers with a quota.

In turn, suppliers without quotas claim that wholesalers with quotas are able to put the squeeze on them.

Oil import officials realize there may be some validity in each case, but they haven't been able to figure out a feasible alternative method.

• Can't appeals board say anything but "no"?

A THIRD BIG PROBLEM at Interior is the disposition of appeal cases. Thus far, the appeals board has followed the simple procedure of rejecting the appeals. More and more companies are getting irked about this, figuring that there is no point in having an appeals procedure, if it is a foregone conclusion that an appeal is going to be turned down.

It would seem logical, therefore, for the appeals board to try to give the industry some specific guidance on the type of cases it will consider and the type it will reject. This would avoid a lot of waste motion for both the companies and the board.

ALTHOUGH THE AUTOMOBILE AX IS FALLING, it isn't painful. Every one of the 24,500 Phillips workers needing transportation still gets to his destination.

Phillips Plugs Leaks—Transportation

Merle F. Blakely
District Editor

PHILLIPS PETROLEUM CO. has found ways to save $750,000 per year in transportation costs. And most important, new ways to save are still being found.

The economy approach was devised by a company-wide committee, representing all major departments and headed by C. W. Haas, director of mechanical maintenance. It was organized in August 1957 and was ordered to find ways to tighten fleet operation and reduce costs.

The committee used a diplomatic approach in its tough job. It had to have employe cooperation, it figured, if it expected to avoid loss of efficiency while trimming costs. It made no changes until the department affected and interested supervisors had been heard or asked to make recommendations.

Informal hearings took 18 months of committee time. Each proposed change was weighed from an operating, employe - relations, and a community and public-relations viewpoint. The over-all plan evolved from this mass of work.

Pools are born . . . The Automotive Requirements Committee first took a tough view of company cars assigned to workers.

Some were being driven 3,000 miles per month, some 2,000. Quite a number, however, were in low-mileage categories of 400 and 500 miles monthly. The problem of these low-mileage cars, with fixed charges eating away at costs during idleness, was tackled first.

Supervisors were asked the operation schedules of car users. If an employe could do his job just as effectively with a car available through a pool, the full-time car assignment was canceled.

Individual car assignments were shaved 20% in this way. These released cars formed the basis for new car pools. In fact, 2 months after the committee began work, it set up its first car pool at Borger, Tex.

Thirteen pools, numbering some 260 cars, are now in operation. They are in Borger, Amarillo, Phillips, Corpus Christi, Houston, Midland, Wichita Falls, and Odessa, Tex.; Denver; Bartlesville and Oklahoma City, Okla.; Wichita, Kans.; and Calgary, Alta. The size of these pools ranges from 74 cars at one location to 7 at another.

A small percentage of pool cars are restricted. These have two-way radios, centrifuges, gaging and testing equipment and are used only by men on specific assignments requiring this type of equipment.

Early dividends . . . Savings popped up fast under the pooling system.

The average monthly mileage of pool vehicles rose 40% above that of the entire company fleet. Cars were used an average of 650 miles more each month than under the former system.

This heavy use overcame some of the minus values. It speeded up the retirement time under Phillips' replacement policy of 40,000 to 60,000 miles, but the company found that trade-in and resale values were higher than for cars driven longer by individuals.

It found also that there was no more wear and tear on cars driven by many drivers than there was on cars driven by the same person.

It also learned that maintenance was improved under the pooling arrangement. When inspection was left to individuals, some minor problems dragged on until they became major repair jobs. In the pools, cars get a routine check each time they are returned.

Costs of license tags, alone, dipped notably under the pool plan. Phillips found it could save $25,000 to $30,000 a year, depending both on the number and type of cars dropped.

How pools operate . . . Phillips uses two kinds of pools.

The larger ones have full-time attendants. Others are headquartered on rear or side lots adjoining Phillips service stations. The station operator checks cars in and out and services them.

In each car is a booklet telling how

Here's the hard core of Phillips' economy drive . . .

Phillips first took a hard look at its 2,600-unit fleet of cars and small trucks in 1957 and decided the fleet was leaking money. It made an extensive study, and in recent months has:

1. Set up car pools to serve concentrations of personnel.
2. Cut by 400 the number of cars assigned to individuals.
3. Downgraded the class of cars assigned to eliminate the near-luxury types.
4. Created two-man satellite maintenance and repair depots to save time and expense of hauling equipment in to major overhaul centers.
5. Put roving mechanical experts on the road to inspect vehicles where Phillips has few people and to authorize repair or replacement.
6. Set up regular bus service in operating centers to eliminate the need for individually assigned cars.

Costs Drop $750,000 per Year

the car can best be operated for long mileage, trouble-free travel, and driver comfort.

Each driver returning a car is asked to fill out a card, mentioning any defects which need mechanical attention. Every car, in this manner, is under constant, if informal, surveillance.

All cars have automatic transmissions and radios. These items are important, the committee finds, when resale or trade-in time comes.

While passenger cars have decreased, pick-up trucks in the Phillips fleet have increased about 12%.

The economizers are playing no favorites. Cars have been withdrawn from some employes who have had them 10 or 12 years.

Too, the cars formerly reserved for higher-echelon supervisors and field managers have been dropped a notch in class to save several hundred dollars in original cost. A few have been kept in the fleet for local "prestige" reasons.

Higher officials in the company now are rolling along in economy models.

Satellite garages . . . Phillips has 16 garages located near heavy vehicle concentrations in six states.

Two of these garages are "satellite" affairs—two-man operations within 40 miles of major overhaul stations.

The main garages are at Odessa, Borger, Houston, Pampa, Tex.; Bartlesville, Oklahoma City, Guymon, and Tulsa, Okla.; Kansas City, Great Bend, and Eureka, Kans.; Smackover, Ark.; Hobbs, N. M.; and Denver. The satellites are at Spraberry and Andrews, Tex., both branches of the big Odessa mechanical center.

The Odessa garage has 36 employes—mechanics, floormen, clerks, stock-room personnel, and mail-car drivers. It is open around the clock, with two full 8-hour shifts and a stand-by crew on the midnight to 8 a.m.

SAVINGS POPPED UP FAST under the pooling system. Cars were used 650 miles more each month.

HUGE WELL-SERVICE TRUCKS are repaired and overhauled. Employes also do the smaller jobs.

tour. About 600 cars and trucks are based here.

Huge well-service trucks are repaired and overhauled. Employes also do the smaller jobs, such as repairing magnetos, generators, starters, and do all manner of machine work. New cars and trucks are inspected and checked out for use. Pool cars are washed, refueled, and serviced.

Thousands of dollars in savings have resulted from inauguration of the satellite-type mechanical depot.

Heretofore, equipment from the busy Spraberry and Andrews oil areas was driven to Odessa for servicing. From either point, the round trip is about 85 to 90 miles. The two small shops do every kind of repair and maintenance. If a major overhaul is needed, the equipment is sent to Odessa.

Roving wrenchmen . . . Phillips now has two types of floating mechanical experts to check equipment in isolated places or in areas some distance from garages.

Odessa garage hands make periodic maintenance trips to Fort Stockton and Ozona to inspect and overhaul equipment used by company seismograph crews. Other trips are made to do preventive maintenance on aviation-gasoline refuelers at airfields in Lubbock, El Paso, Midland, and San Antonio.

Because Phillips is doing business in 41 states and Canada, establishment of garages to service all equipment used would be unwarranted. That's why the committee decided to put its mechanical experts on tour.

For instance, a mechanic based in Omaha, travels a four-state area of Minnesota, North and South Dakota and Nebraska. He makes periodic checks of all vehicular equipment. He decides what repairs are needed, and a local garage is given the job. He then inspects the completed repair job when the equipment is returned.

And buses, too . . . The prying committee didn't quit with car pools.

Members found that even with a car pool at Borger, many cars were not being fully used.

Need for transportation is great in Borger. The company has a gasoline plant and huge fractionating center; a computing center; a refinery; butadiene, rubber, and specialty chemical plants; warehouses and office personnel for each; plus producing and pipeline operations and staff and service personnel.

Every day Phillips people from other cities and states pay official visits to Borger. Cars formerly were checked out to them. Some cars were driven 8 to 20 miles only a day, remaining parked much of the time.

ONE MECHANIC based in Omaha travels this three-state area, making periodic checks of all vehicular equipment, and a local garage is given the repair work needed.

A year ago, two buses were put in service. They are on regular schedules from 7:30 a.m. to 5:30 p.m. on a 16-mile round-trip route. Thirty-minute service to any Phillips installation is possible for any Phillips worker. No tickets nor tokens are necessary.

Has it paid off? The committee has reduced the number of cars in Borger—both assigned and in the car pool—by 22. This has worked an annual savings of $35,000. It also is considered a time saver for employes.

The white, eight-passenger buses haul an average of 127 passengers daily, which means there seldom is a dead-head trip and most times the carriers are three-fourths full.

Squeeze goes on . . . The committee still is looking for more economical ways to keep rolling stock rolling.

Spurred by a statement of Chairman K. S. Adams that "it takes nearly $100,000,000 of additional sales income in competitive times to make $1,000,000 more net profit," the committee is out to make a million via the garage back door.

The committee now is doing a double cut.

It is reducing size of the car pools. Example: One pool was started with 29 cars. Later it was reduced to 21. And this year it is operating efficiently with 17, serving the same number of Phillips people. Another pool has been cut 46% with number of cars reduced from 30 to 16. Every pool, by experience, has been streamlined. The reduction has ranged from 15 to 58%.

Critical Path

DU PONT has a new technique for planning maintenance and engineering jobs for the most economical turnaround schedule.

The new technique is called critical path planning and scheduling. Under it the old work-order forms, spare-parts forms, and preventive-work schedules are gone.

The plan was revealed by R. C. Steinfield of the Wilmington, Del., firm at the computer conference of the Western Petroleum Refiners Association meeting in Houston.

The philosophy behind the new technique, said Steinfield, is that it is impossible for the human brain to hold to the most economical turnaround schedule. The brain cannot quickly evaluate all the variables that occur during a turnaround and decide which is most important.

With that in mind, Du Pont researchers devised three major divisions for critical path planning and scheduling. They are arrow diagraming, computation, and linear programing.

Arrow diagraming . . . A job is needed in the plant, such as replacing a pipe run or installing a heat exchanger.

This is the procedure: Write all the steps needed to do the job. Then, using arrows, put the steps in sequence on a diagram. This will show that some steps can proceed concurrently

PIPELINE

Contracts have been awarded on two of the three sections of Buckeye Pipe Line Co.'s 54-mile crude-line extension in Michigan. Panama-Williams Corp. will build 14 miles of 22-in. between Toledo, Ohio, and Samaria, Mich., and a crossing of the Maumee River. Somerville Construction Co. received a section of 16-in. in the Detroit area. The $4-million project was scheduled to get under way last week.

A $2,049,330 project, including a 36-in. crossing of the Illinois River and underground-storage facilities, has been approved for Natural Gas Storage Co. of Illinois by the Federal Power Commission. The facilities, in Kankakee and Grundy counties, Illinois, will permit a maximum-day withdrawal increase of 75,000,000 cu. ft. from Herscher and Cooks Mills storage, boosting capacity to 650,000,000 cu. ft. daily. The new supply will

Planning Means More Economical Turnarounds

with other steps but there are steps that need priority.

The arrow diagram represents a logical statement of the plan. To complete the diagram, dummy arrows are added. They show the relation of one part of the job to another and to outside events, such as line availability and lead time. They also show the relation of the job to the plant as a whole.

Computation . . . The standard time to do each step is estimated and applied to the arrow diagram.

The arrow diagram is changed to a mathematical model, and the diagram is put on a computer.

The computer then calculates the critical path using matrix algebra to solve for the earliest finish and latest start of each step. The critical path is the sequence of arrows going from start to finish that take the longest time.

TYPICAL ARROW DIAGRAM shows replacement of heat exchanger with spare.

Linear program . . . The critical path first defined is for only one case, generally the longest time-least cost.

There is no consideration given to the cost of lost production, since more calculations are needed to evaluate this.

Additional data for each step, showing the range in cost from a maximum cost-least time to the least cost-maximum time, are entered into the program. The computer then calculates a whole spectrum of time-cost relations.

After comparison with the cost of lost production, an economic time and cost for the job is established. All final planning is made on this basis.

A bar graph of the job finally is made. Critical path steps, dates, and other pertinent information are shown at the top. Next are the other steps of the job, including sequence of noncritical steps, when they start, and how much they can float without affecting critical-path and other steps.

The bar graph is given to the foreman for execution. He makes no written reports as long as everything is on schedule.

BRIEFS . . .

permit the connection of 20,000 new space-heating customers in Chicago, boosting the number to 370,000 compared with 39,000 in 1945.

Temporary authority to build a 17-mile 10-in. line from Thibodaux, La., to Bayou Chevreuil field, Lafourche Parish, Louisiana, costing $965,200, has been granted Texas Gas Transmission Corp. by FPC. The line will connect a new source of supply to the Texas Gas system. Commissioner William R. Connole dissented in the decision. Texas Gas also received authority to spend $3,000,000 to connect other gas fields near its system.

Canadian oil-pipeline deliveries increased 2.7% in March to 28,064,000 bbl. compared with 27,331,138 bbl. in March of 1959. For the first quarter deliveries were 86,962,344 bbl. compared with 83,540,967 bbl. for the corresponding period the previous year. Barrel-miles of traffic rose 8.5% in March. Operating revenues for the first quarter rose 8.8%.

A 20-mile 8-in. line is being laid in Jones County, Mississippi, by Sharman, Allen, Gay & Taylor, Houston, Tex., for Interstate Oil Pipe Line Co. Work started last week.

Approval to connect new gas supplies has been granted by FPC to Michigan Wisconsin Pipe Line Co. Authority was received to spend $3,000,000 during the next year, with no project to exceed $500,000.

An 11.6-mile 12-in. offshore line will be built by Tennessee Gas Transmission Co. to take gas from its own reserves in Block 17 field, East Cameron Area, Louisiana. FPC has given Tennessee temporary authority to tie in the reserve estimated at 103 billion cubic feet. Cost will be $1,031,000.

Construction on the first section of a 29-mile 36-in. line in Chicago costing $23,000,000 will be started soon by Peoples Gas Light & Coke Co. The line will extend from Peoples' North Shore station to its Calumet station on the far south side of Chicago. Built over a 3-year period, the line will provide increased capacity and, with interconnections, will permit greater flexibility in meeting peak gas demands.

The first shipment of a butane and isobutane mixture by Service Pipe Line Co. from the Mid-Continent area will be made this month. Service will receive the product, some 500 bbl. daily at first, from Okan Pipe Line Co. at Drumright, Okla., for delivery to the Wood River, Ill., refinery of its parent, Standard Oil Co. (Ind.). Vapor pressure of the light product, ranging from 53 to 70 psi., will be the highest ever transported by Service in its crude system.

Seaton Whacks Third-Quarter Resid Quotas

• Outlook: Happy coal men and a busy import-appeals board following Interior's heavy slash in quotas.

INTERIOR department set the stage last week for some sharp controversy, punctuated with charges of politics, when it announced oil import quotas for the upcoming allocation periods.

It slashed residual fuel-oil quotas for Districts 1-4 to 250,000 bbl. daily for the 3-month period beginning July 1. This is nearly 50% below the quotas for the January-July allocation period and about 15% below actual imports in the third quarter last year.

Interior also reduced crude and unfinished-oil quotas for Districts 1-4, although relatively only slightly. For the 6 months beginning July 1, the total will be 694,328 bbl. daily.

For the current period, which will end June 30, the level is 718,087 bbl. daily.

During the last 6 months of 1959, the total was 682,707 bbl. daily. Thus, although quotas for the last 6 months of this year will be below those of the first 6 months, they will be slightly higher than for the last 6 months of 1959.

For District 5, quotas for crude and unfinished oil were increased to 263,303 bbl. daily from the present level of 220,095. For Puerto Rico, the level remains unchanged at 80,883 bbl.

Resid a surprise . . . Interior's action on residual fuel was the big shocker.

It pleased the coal industry, which has been charging that imported residual was being "dumped" at low prices along the East Coast, forcing coal out of some of those markets.

Top coal officials called on Interior Secretary Fred Seaton recently, and coal state congressmen met with him the day before the quotas were announced.

Their plea was that residual-fuel imports be at least kept at the base year (1957) level. As it turned out, Interior cut the quotas even below the level for the same period of 1957.

This action outraged residual fuel importers, distributors, and dealers and is likely to bring a rash of appeals before the import-appeals board.

When the residual fuel quotas for the current January-June period were announced last December, importers protested that the total was too low. They continued to warn Interior of a pending residual shortage until Interior finally increased the quotas, although the increase was only about half what the importers said was needed.

As a result, they had hoped that for the new allocation period the quotas would be high enough to permit stock rebuilding.

Instead, quotas for the July-September quarter will be even below what they were for the same 3 months of last year.

Perhaps the bitterest blow of all, for importers, was the fact that the July-September levels are less than those of the same period of the base year, 1957.

Pressure on crude . . . Interior's quotas for crude and unfinished oil are less likely to stir controversy, since they vary little from current levels.

However, crude-oil producers have launched a campaign urging the government to make substantial reductions in crude imports.

It is likely that this campaign will be given increasing emphasis in the months ahead.

For the finished products, other than residual fuel oil, Interior authorized imports of 76,634 bbl. daily into Districts 1-4; 6,753 bbl. daily for District 5, and 354 bbl. daily for Puerto Rico. These were virtually unchanged.

How Interior Changed Crude-Oil Import Percentages

Average Runs (Bbl. daily)	DISTRICTS 1-4* Current Per Cent	DISTRICTS 1-4* New Per Cent	DISTRICT 5 Current Per Cent	DISTRICT 5 New Per Cent
0-10,000	13.0	11.8	35.4	45.0
10,000-20,000	11.9	10.8	28.3	36.0
20,000-30,000	10.8	9.8	21.2	26.9
30,000-60,000	9.7	8.8	14.1	17.9
60,000-100,000	8.7	7.9	11.3	14.4
100,000-150,000	7.5	6.9	10.3	13.1
150,000-200,000	6.5	5.9	9.4	11.9
Over 200,000	..	..	7.5	9.5
200,000-300,000	5.3	4.9	..	..
300,000 and up	4.3	3.9	..	..

*New percentages are lower than originally proposed (OGJ, May 16, p. 92).

Russian Gasoline May Soon Move Into Canada

GOVERNMENT OFFICIALS in Ottawa have confirmed reports that some Canadian distributors hope to import $9,000,000 worth of Russian gasoline.

The names of the companies were not disclosed. However, it is understood that 60,000,000 Imperial gallons of gasoline would be imported initially. The price to distributors would be 15 cents a gallon, or about 12.5 cents per U. S. gallon.

Government trade men are eager to promote the purchase for the beneficial effect it will have on the operation of the new Canadian-Russian trade agreement. Under the agreement, Russia is committed to spend $2 in Canada for every $1 worth of Russian goods shipped to the country.

However, a government source said some thorny problems are being encountered and some time will be required to resolve them.

He said government officials are trying to fix duties on the gasoline which will be fair to competitive suppliers, but not high enough to discourage the prospective importers.

The official said the government is trying to set a value on the gasoline for duty purposes which can be applied to subsequent shipments.

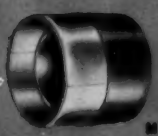
Russia's state-owned oil industry made an earlier effort to sell crude oil in Canada, but none of the refiners showed any interest.

The new proposal by-passes the refiners, by delivering gasoline to the wholesaling firms.

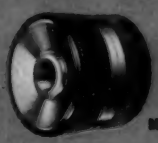
The gasoline, to be delivered at eastern ports, would not affect sales of Canadian crude oil to refiners. It is expected the displaced oil would be Arabian or Venezuelan.

* Mission pump parts work together

MISSION VALVES



MISSION GLAND PACKING



MISSION PISTONS

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MISSION LINER PACKING

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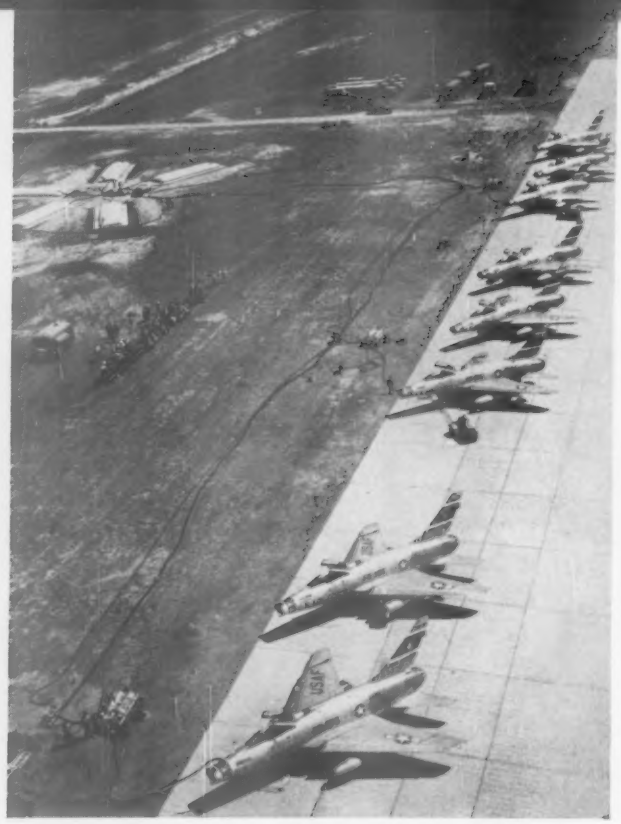
[illegible]

PHOTOS IN THE **NEWS**

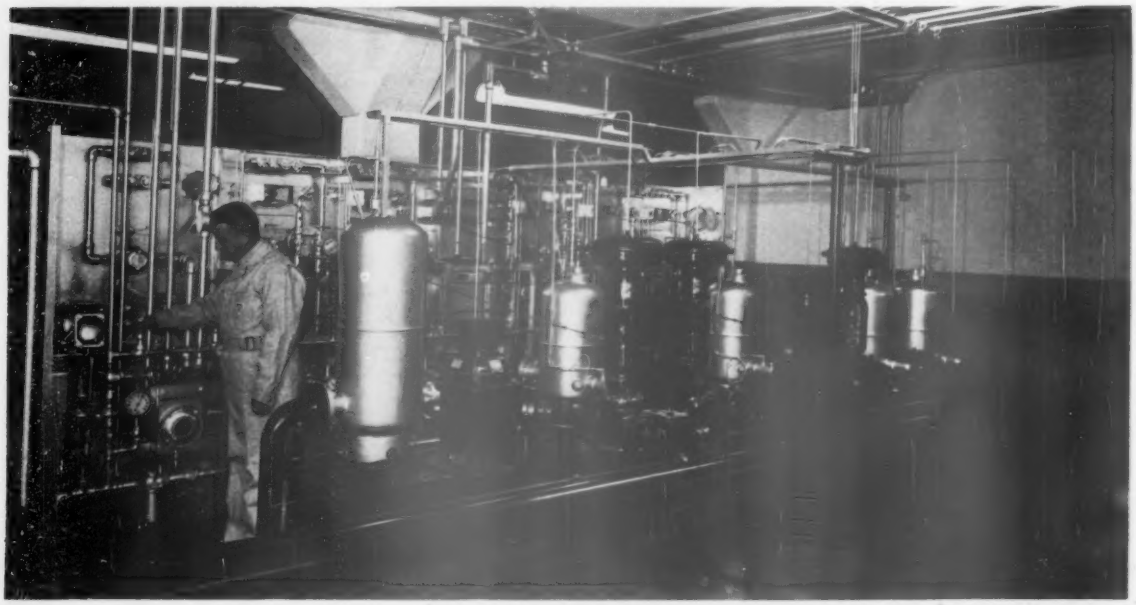
Humble's Basement

Butyl rubber produced in Humble Oil & Refining Co.'s Baytown refinery is being used to waterproof the basement of Humble's 44-story building in Houston. Humble will pour 7 ft. of concrete on top of the ⅛-in. butyl sheet, well below ground-water level.



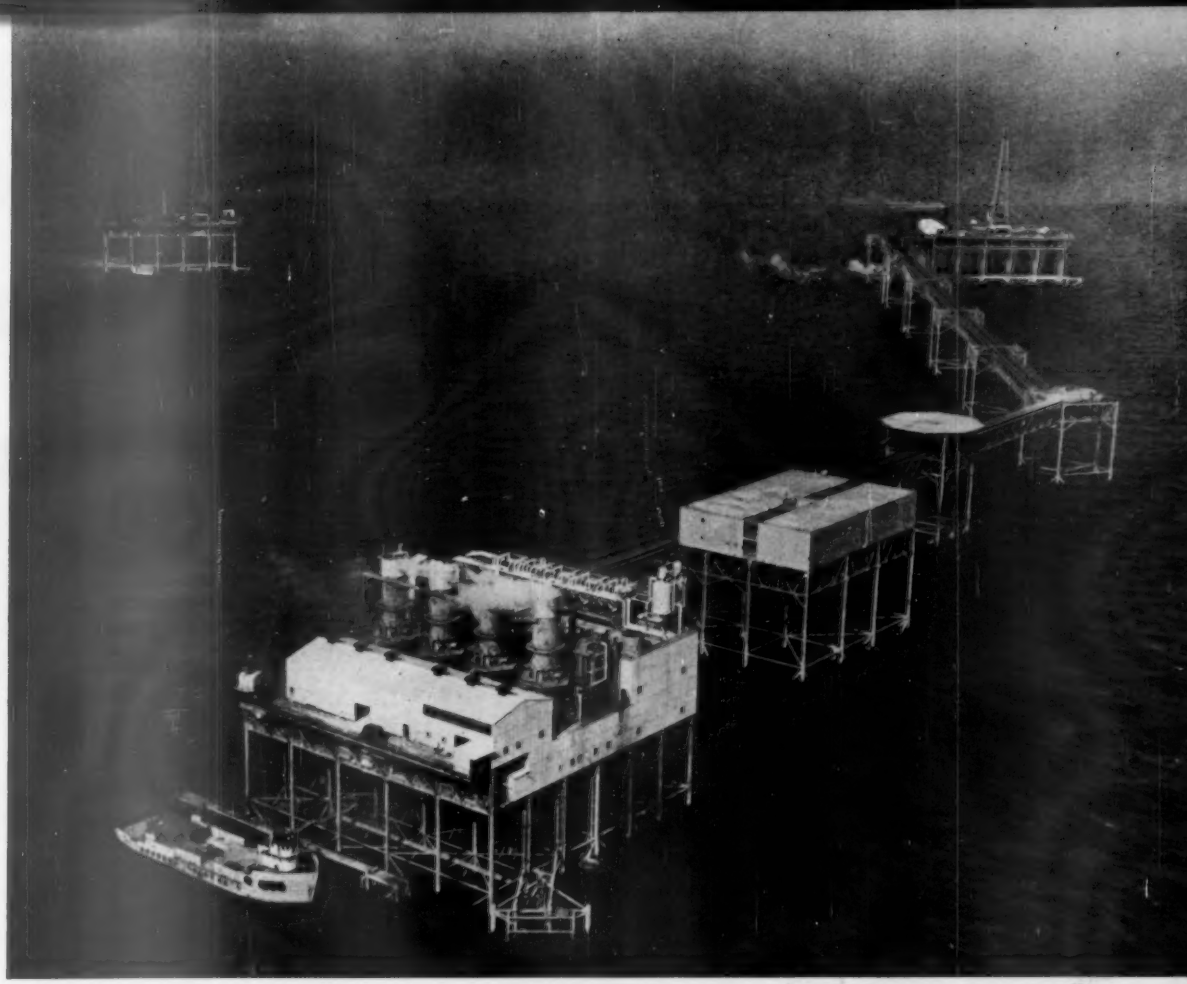
Fast Fueling

Using pillow tanks at left, Air Force fueled these eight jet fighters in 27 minutes. Tanks, made by Goodyear, hold 50,000 gal., can be moved by plane. System, developed for Tactical Air Command, can fuel all types of jets at 150 to 600 gal. per minute. It also filters fuel and removes water.



New Look in Lubes

An automatic blender and homogenizer feature Continental Oil Co.'s expanded and modernized compounding and packaging plant at Ponca City. Shown here are meter and control instruments for the new units. New facilities cost $750,000, include automatic palletizing equipment for handling drums, empty-can handling machines, and an extra 34,000 sq. ft. of warehouse space.

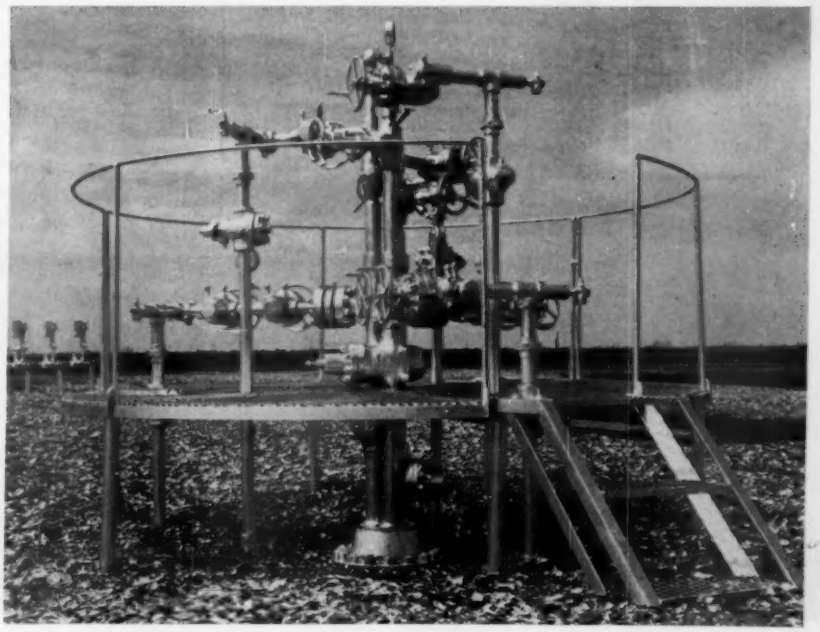


First Offshore Sulfur Mine

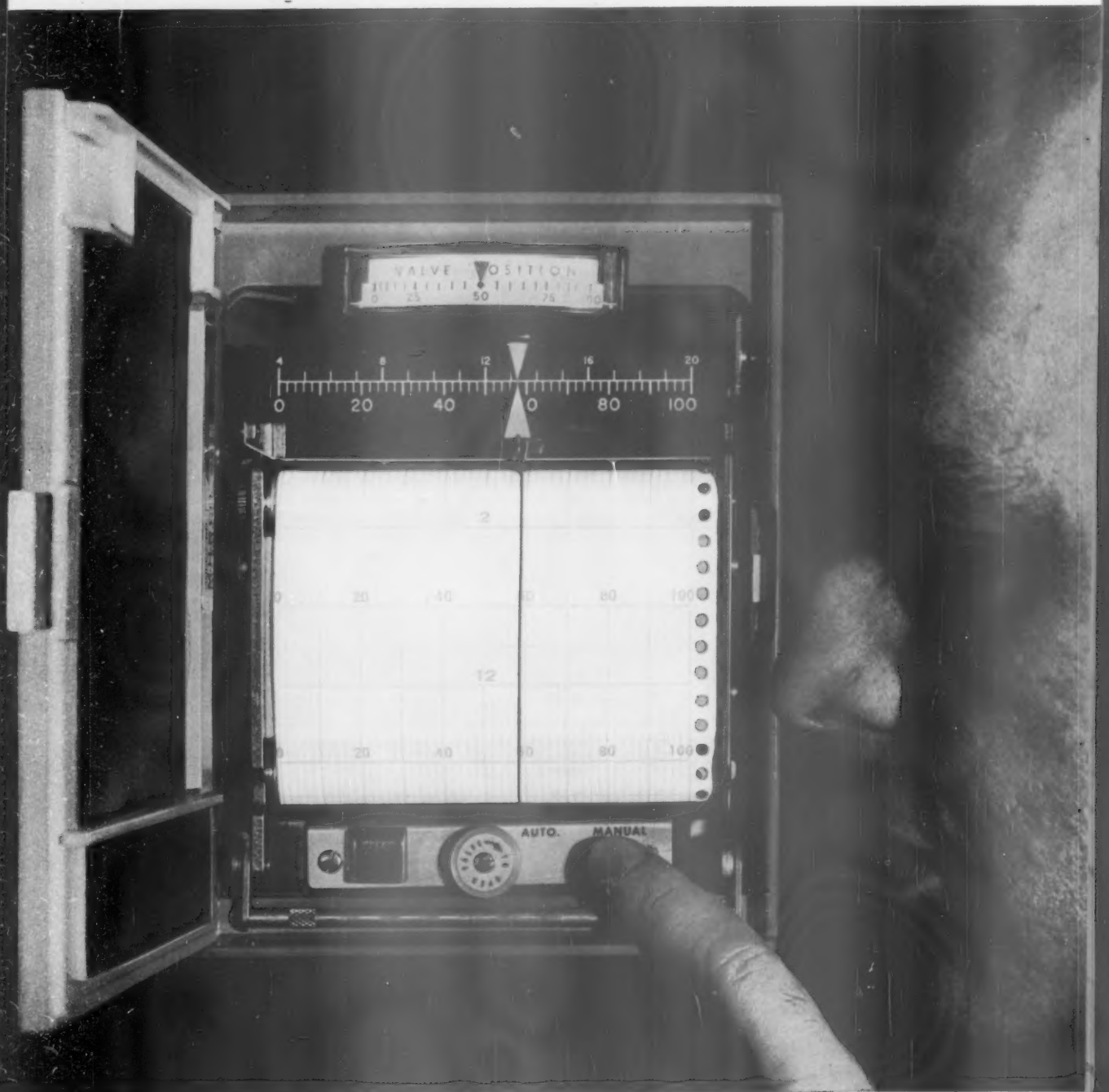
Freeport Sulphur Co. has put into operation this huge offshore facility—the world's first offshore sulfur mine—in 50 ft. of water 7 miles off the Louisiana coast. Platform contains boilers, generators, drilling rig, and other facilities for recovering sulfur from formations 2,000 ft. deep. The deposit, one of the largest known, was found by Humble Oil & Refining Co., which will receive half of the net profits.

Sunray's Sextuple

A little gravel and a paint job turned the world's first sextuple completion into this attractive sight. The well was completed by Sunray Mid-Continent Oil Co. in late May in Jackson County, Texas. It flows from six zones through three strings of 2½-in. tubing, each containing a string of 1½-in. tubing. For its completion picture, see May 23 issue, page 66.



New *ElectriK Tel-O-Set*... needs in a single compact



everything an operator control station

This Honeywell electric control station meets all of your requirements for operator convenience.

One compact case houses *every* function the operator needs to supervise a control loop: indication of process variable and set point on the same scale; the controls needed to switch from automatic to manual; controls for manual control; and indication of valve position.

The *ElectriK Tel-O-Set* control station assures easier bumpless transfer than ever before available because there's no need to "line up" or "match" pointers. A null balance indicator eliminates guesswork, and the transfer doesn't have to be hurried since the valve remains under control during the transfer.

You can also order the controller with the proportional band, rate, and reset adjustments on the front of the panel conveniently located below the control station, or at the rear of the panel.

These are just a few of the features that make the new *ElectriK Tel-O-Set* control system an outstanding value. Your Honeywell engineer can give you complete details. Call him today . . . he's as near as your phone.

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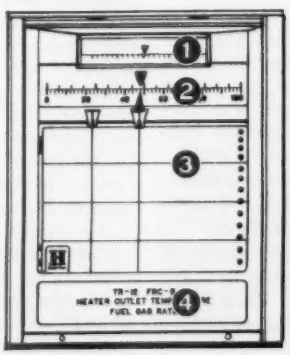
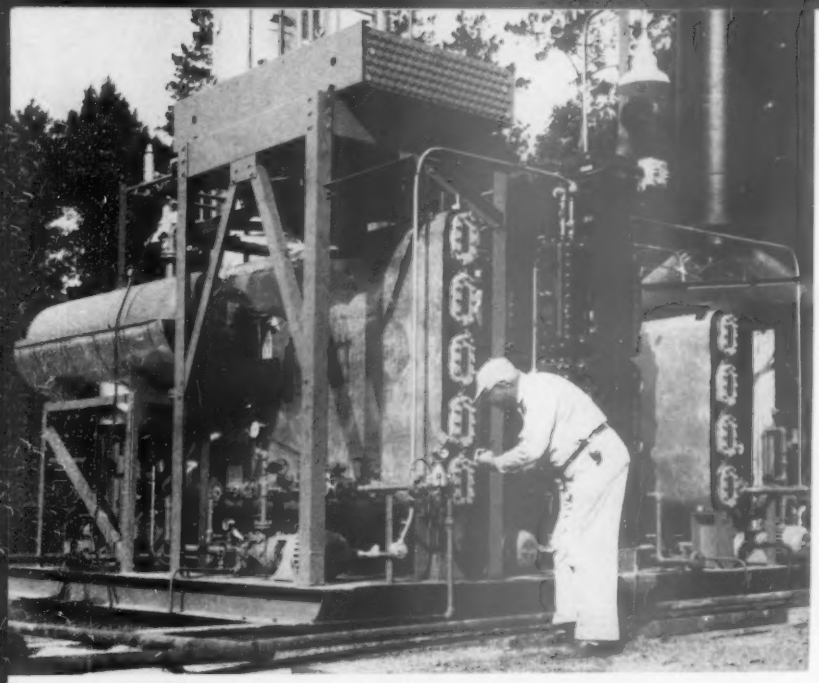


1 Valve position indicator continuously indicates controller output when on automatic control.

2 Set point index is conveniently located on same scale as process-variable pointer; you can see from a distance any deviation of variable from set point.

3 Rectilinear 4-inch calibrated chart is easy to read. At standard chart speed, four hours of recording is always visible. Unit has daily chart tear off or 30-day rewind. Both recorder and control station take the same 5½" x 6" panel cutout.

4 You get bumpless switching from automatic to manual control because you don't have to match pointers. In the balance position, the valve position indicator is part of a null circuit that compares controller output and manual output. When indicator reads 50%, both outputs are perfectly matched.



IN ADDITION to testing crude in world's farthest-south producing area . . .

Tom Thumb Refinery Will Fuel Tierra del Fuego Rigs

A PORTABLE crude-distillation unit soon will be in operation near the southern end of the world.

Primarily it will field test crude produced on Tierra del Fuego by Tennessee Argentina, S.A.

Also, it will provide fuel for Tennessee's exploration program and help solve a tough logistics problem which is especially severe in winter.

The 200-bbl. per day unit is designed for easy portability. All equipment is mounted on four skids, and any one skid can be hauled by one truck.

The background. Tennessee Argentina, S.A., a subsidiary of Tennessee Gas Transmission Co., contracted in 1959 with YPF, the Argentine government oil agency, to explore for and produce oil and gas on 3,435,000 acres of the Argentine part of Tierra del Fuego island (OGJ, April 27, 1959, p. 104).

The company employs 219 people, 180 of whom are Argentine nationals. It is operating four drilling rigs and one seismic crew.

To test the crude and provide fuel for its own use Tennessee contracted with Williams Brothers Co., Tulsa, to build the 200-bbl. portable refinery. Williams Brothers has used portable units to provide fuel for pipeline construction in Bolivia.

The crude unit was engineered and designed by Litwin Engineering Co., Wichita, Kans., and constructed by Belmas Co., Houston.

It was field tested on one of Tennessee's leases near Cleveland, Tex. Process Operators, Houston, provided the personnel for testing. The unit is now being crated for shipment to Tierra del Fuego.

The unit. The $70,000 pilot testing topping unit is designed to process 42° API sweet crude into gasoline, diesel fuel, and topped crude.

It is mounted on two process skids, one furnace skid, and an electric-power skid. These skids are flanged and bolted together and can be moved easily.

The vertical furnace is gas fired and all electric motors are alike for interchangeability. The instruments are electrically operated and no air or steam is used. Construction is of carbon steel. Air cooling is used for condensing.

Provided with the unit, but separate from the process equipment, is a manifold for tetraethyl-lead blending.

On startup testing at Cleveland, the unit performed exceptionally well, and no changes were needed. During testing the unit operated at rates as high as 240 bbl. daily.

New Laboratory

- This year there should be some action to get a program started to find better methods to check premium gas quality.

MUCH-NEEDED improvements in knock-testing have moved one step nearer realization.

Action pointing to an intensive development program for new laboratory methods is expected this year.

This does not mean that refiners will see any relief from their present problems for some time. Much study and evaluation remains before new fully authorized ASTM tests can be made available.

The necessary time lag makes immediate action imperative, in the opinion of leading technologists. Outmoded laboratory tests are today costing refiners millions of dollars a year in testing, reblending, correlation and octane giveaway.

But encouraging progress is being made. Recently, the API Automotive Research Committee accepted a report from a sub group which terminated its study, made recommendations for action, and disbanded.

The Subcommitte on 100 Plus Octane Methods, headed by J. J. Nikita

PROCESSING

Construction work on the British Petroleum Co. group's first refinery in North America has been completed. The 25,000-bbl. daily plant at Ville d'Anjou, near Montreal, Canada, will be operated by BP Refinery Canada, Ltd.

A new control laboratory, with special equipment for testing waxes, lubes and greases is being added to the Standard Oil Co. (Ohio) No. 2 refinery at Cleveland. When completed in November the $170,000 facility will perform precision blending and packaging of experimental field-size batches of new oil and wax formulations to be marketed by the company.

An expansion of the Koppers Co. plant at Oil City, Pa., is planned to produce a broader line of alkylated phenol. Among the first of the new products of the plant, which is ex-

Tests for Gasoline Octane Ratings Are Coming

of Du Pont, conferred with laboratory personnel throughout the country. Its report left no doubt that a new approach to laboratory octane testing methods is surely needed.

The group reported these conclusions:

... **There is a need** for more satisfactory methods for quality control and for predicting the road performance of gasolines.

... **Formulas** for calculating road octanes using Research and Motor ratings and fuel compositions receive mixed acceptance today. Most research people dealing with this problem feel that these correlations are becoming more difficult to apply as octanes rise and fuel compositions change.

... **The reproducibility** of the research method in the 100 to 103 octane range has been greatly improved in the past 3 years. Further progress is expected, but it will come gradually.

... **Reproducibility** of the motor method is much poorer than that of research. At octane levels above 95 the standard deviation is so great that the method is of questionable value.

... **It appears certain** that new methods meeting most of today's requirements can be developed.

... **A large majority** of interested technologists would cooperate in a program of updating the knock-test methods through the use of a new cylinder, new instrumentation, a new fuel system, and a new air-induction system.

On the basis of these conclusions, the subcommittee made three recommendations:

1. A cooperative program should be started on the development of new methods for evaluating the knocking characteristics of motor fuels. As the motor method lacks precision, first priority should be given to development of a replacement for this method.
2. The responsible technologists should accelerate further work in the interim to improve the reproducibility of the motor method.
3. The personnel of the responsible groups should be supplemented with additional men of high technical competence, in order that the pace of activity may be accelerated.

Action is now up to the responsible technologists of both producers and consumers of motor gasolines to see to it that ASTM or some other qualified organization follows through on these recommendations.

No new problem . . . Refiners have felt the need for a better approach to laboratory octane rating for several years. This need has sharpened as gasoline quality moved to the 100 RON level.

Reproducibility is only one aspect of this problem. Refiners today are struggling with serious blending anomolies. These are generally attributed to the peculiar behavior of certain hydrocarbons. It is now recognized that the fault often lies in the peculiar behavior of the knock-test engines.

Additives pose another problem. Many are found to behave differently in the laboratory and on the road.

Why this discrepancy? The reason seems to lie in the fact that present lab test engines do not stress gasoline in the same thermodynamic regime as that existing in full-scale multicylinder engines. The conditions which induce knock are not the same in the lab and on the road.

Thus a new approach seems in order. Members of the study group feel that the basic CFR engine could be modified to duplicate road conditions more closely with design changes in the cylinder, induction and fuel systems.

Two such engines to span the severity range would, according to best evidence, permit better correlations with road performance. They would take much of the mystery out of the blending characteristics of fuels.

If this new approach is followed, laboratory test methods should not be subject to the same degree of obsolescence as present ones. Those close to this problem are impatient to get on with the work required to bring about these new improvements.

BRIEFS . . .

pected to be on stream by July 1, are para-tertiary butyl phenol, para-tertiary amyl phenol, di-tertiary amyl phenol and both 2,4 and 2,6 di-tertiary butyl phenol.

A contract for design, engineering and construction of a styrene monomer plant in Houston for Sinclair-Koppers Chemical Co. has been awarded to Badger Manufacturing Co. The plant, which has a design capacity of 70 million pounds a year, will be the largest of its type.

A gas chromatography research center is to be established in Houston by the Wheelco Instruments Division of Barber-Colman Co. The center will work with refining laboratories to develop new instruments, techniques and accessories for the oil industry.

Shell Oil Co.'s first lube-oil Hydrofining unit will be built at its Houston refinery by Procon, Inc. The unit will use the Shell trickle phase process to remove sulfur and other trace components from lube-oil stocks. It will replace a clay contact treater.

Residue gas from a new plant, being completed near Albion, Mich. by Ohio Oil Co. and Humble Oil & Refining Co., Carter Division, to process casinghead gas from the Scipio-Pulaski trend, will be purchased by Consumers Power Co. of Jackson. About 10 million cubic feet daily will be distributed by Consumers to customers in the Detroit suburban area and in southeastern Michigan. Later, this will be increased to 30 million cubic feet daily. Ohio and Humble will extract propane and natural gasoline from the gas.

A combination UOP Unifining-Platforming unit with a 4,700-bbl.-daily capacity is on stream at Gewerkschaft Erdol-Raffinerie Emsland at Lingen, Germany. It produces a high-octane gasoline for blending purposes.

Also for Refiners . . .

IN THE NEWS: Central Kansas producers find partial market for their oil shut in after Derby's price cut—but the commission order may get a court test (p. 72) . . . Du Pont has a new technique for planning maintenance and engineering jobs for the most economical turnaround schedule (p. 78) . . . Portable midget refinery will field test Tierra del Fuego crude and provide fuel for drilling rigs (p. 76) . . . New lab tests for gasoline octane ratings are nearer reality (p. 76) . . . Japanese refiners team with electric firms in fuel-steam exchange (p. 89).

PLUS THIS TECHNICAL REPORT: A fresh look at the isomerate process (p. 120).

California Studies Leasing Methods

• The newly appointed State Lands Commission is getting its first brush with offshore leasing practices at Los Angeles hearing. The agency hopes to come up with a plan for leasing land off Santa Barbara County late this year.

CALIFORNIA'S State Lands Commission, whose three members are all new appointees, got a lesson in offshore leasing last week.

It was this: The oil industry doesn't necessarily agree on what is the best way to lease an offshore tract.

This difference of opinion was obvious when the new commissioners held hearings in Los Angeles in an effort to determine if the state should change its leasing procedure.

Richfield Oil Corp. was on one side of the fence and the remainder of the operators on the other.

Richfield, represented by Vice President R. W. Ragland, favors a fixed royalty rate as the basis for awarding leases. And Richfield gave every indication it is willing to pay more than the standard 16⅔%.

Richfield's stand brought sharp comments from Standard Oil Co. of California, Humble Oil & Refining Co., and Shell Oil Co. This trio favors awarding leases on a cash-bonus basis with a sliding royalty. Shell would like to see the sliding-scale royalty cut down, but would go along with the current rate if bonus-bidding is continued.

California used the cash bonus and sliding royalty combination in awarding its last offshore leases (OGJ, July 7, 1958, p. 72).

Just what the commissioners will do is not known. They were named only last year by Gov. Edmund G. Brown and have never directed an offshore lease sale.

The state hopes to lease about 50,000 acres of tidelands off Santa Barbara County sometime late this year, but the commission first must set up some ground rules. The prospective land is between the tracts leased in 1958.

Members of the commission include Lt. Gov. Glenn Anderson, Comptroller Allen Cranston, and Director of Finance John Carr.

Offshore future . . . Ragland said California's tidelands are the best hope for boosting the state's oil production.

"For really important new sources of oil, California must look offshore," he said. "Most oil men believe that if any really important new oil field is discovered inland, it will be either at extreme depth or under conditions which are now very obscure geologically."

The Richfield executive said the oil found to date on the areas near the land up for consideration is a better quality crude than found in much of California. It is rated at about 38° gravity and is a good gasoline crude.

A much less optimistic picture of California's offshore prospects was painted by L. E. Scott, division land supervisor at La Habra for Socal. Scott said no marketable oil has been produced from the 19,200 acres leased off Santa Barbara County in 1958.

He said Socal has drilled a dry hole on Parcel B and several wells drilled on Parcel C are "inconclusive and somewhat discouraging." Socal and Humble hold the two tracts in a joint operation.

Richfield's stand . . . Ragland did not specify what fixed royalty the commission should set in granting additional leases, but he used a 20% royalty in one of his examples. He referred to the 20% royalty rate later and indicated he might think this is an adequate minimum figure.

Richfield also favors a "substantial" first-year rental which would be high enough to keep out promoters who would "peddle" the leases, retaining an overriding royalty. When questioned by one of the commissioners on what a "reasonable" rental would be, Ragland said between $500,000 and $1 million.

By awarding leases on a fixed royalty rate, the state would give oil operators a concrete figure to work on in determining costs and payout, he said. The fixed rate would remove "elements of uncertainty."

In order to prevent abandonment of a field due to an excessive royalty rate, Ragland suggested the state pass a law which would enable the commission to renegotiate and reduce the royalty on a lease when it reaches the stripper stage.

The other side . . . Humble, Socal and Shell took issue with much of what Ragland proposed and favor a bonus-bid with a sliding-scale royalty as the basis for awarding leases.

W. R. Gardner, speaking for Humble, said the state shouldn't gamble with its resources by adopting a fixed royalty rate on leases. If a lease proves dry, the state gets nothing under this procedure but under bonus-bidding, the state earns money even though the lease may be dry.

Gardner said companies will also work harder to get their money out of a lease if they have a big cash bonus invested in the property. On the other hand, he said, if a cash bonus was not paid, but a high royalty rate charged, the operator would abandon the lease as soon as income failed to exceed operating costs.

Cash shortage? . . . While being questioned, Ragland admitted the companies would "get out cheaper" with cash bonus bidding "if we all had the cash." He indicated Richfield didn't have the cash to compete in this kind of bidding.

Scott of Socal made a reference to Ragland's remarks about cash later when he pointed out Paria Operations, Inc., bid $101 million for leases in the Gulf of Paria. Cities Service Corp., which holds a substantial interest in Richfield, is a member of Paria Operations.

In arguing for the bonus-bidding technique, Scott contended there are plenty of companies interested in offshore lands and with money available to make cash bonuses.

He cited a February lease sale of lands off Louisiana and Texas where oil companies submitted bids totaling $750 million. Of this total, bids totaling $285 million were awarded.

"Approximately $500 million went unclaimed and is apparently available for other bidding which will attract this competition," he said.

Shell's spokesman D. E. Clark, left no doubt where his company stands on the fixed royalty vs. bonus-bidding argument.

"Without any equivocation we prefer bonus bidding," Clark said.

The final witness at the hearing was Edwin W. Pauley, Los Angeles independent operator who heads a 40-party combine which won one lease in the 1958 bidding.

Pauley said those who favor a high fixed royalty fall into two categories: The independents who don't have the money for a cash bonus and can't raise the money and the companies which want to build up crude reserves with as little capital outlay as possible.

Japanese Refiners Team up with Electric Firms

• The refineries will supply fuel oil for the boilers of electric power plants. And the power plants will provide steam for the refineries. The joint deals will trim the use of coal and water power for generation.

ONE OF JAPAN'S major refiners and one of the country's big electric power companies have joined forces in a project that promises to establish a new Japanese trend.

Daikyo Oil Co. and Chubu Electric Power Co. plan a refining-thermal power generation project at Yokkaichi.

The two firms have had no previous affiliation and the joint venture points up a new trend of thinking in Japan that will increase the use of fuel oil in electric power generation at the expense of both coal and hydroelectric projects.

Here's how the new project will work:

. . . Daikyo will build a 60,000 bbl. daily refinery on 220 acres of reclaimed land at Umoakoshi, Yokkaichi.

. . . Chubu Electric will construct a 600,000-kw. power plant on 60 acres which it will buy from Daikyo adjacent to the new refinery.

The refinery will have twin 30,000-bbl. daily distillation units, one of them to be used primarily for fuel-oil production which will be piped directly to Chubu Electric's power plant boilers where it will be used as fuel without any preheating.

In return, the power plant will furnish the refinery a steam supply.

Daikyo estimates it will supply about 6.3 million barrels of fuel oil a year to the power plant and will probably get a 70% fuel-oil yield on the Persian Gulf crude which the company plans to buy from Arabian Oil Co., the Japanese firm now developing Kharji field in the offshore Neutral Zone.

Completion date for the joint project is the fall of 1963, which is after Japan's existing boiler restriction law expires. The controversial boiler law was enacted in August 1955 for the express purpose of restricting fuel oil as boiler fuel to protect Japan's coal industry. The law was to be abolished after 5 years, but the government recently extended it another 3 years.

Limited locations for building hydroelectric power plants and the high cost of coal have both contributed to Japan's growing trend to more fuel-oil use in thermal power generation.

Other plans . . . In addition to the Daikyo-Chubu contract, which was the first such deal made in Japan, others of a similar nature are being discussed. Maruzen Oil and Tokyo Electric Power are considering an almost identical tieup for refinery and thermal power units at Goi; Idemitsu Kosan and Chubu Electric are talking about another at Yokosuka; and Arabian Oil Co. and Kansai Electric Power may build the fourth at Osaka.

Recent forecasts by the Ministry of International Trade and Industry point up the country's need for further electric power and highlight the growth of thermal generation over hydroelectric. MITI says Japan's electrical power demand this year will be 82.8 billion kilowatt hours. Of this total 57.5% will come from hydroelectric plants and 42.5% from thermal generating plants.

Fuel oil is expected to supply 25% of the thermal generating power and coal the other 75%. This contrasts with the 1956 division between the fuels of 86% for coal and only 14% for fuel oil.

The increase of thermal generation shows up pretty sharply when the 1960 ratio between hydro and thermal generation is compared with the 75-25 ratio in 1956 when hydro plants furnished the bulk of Japan's power.

Russia Expands Its Oil Markets

. . . In Ethiopia

SOVIET RUSSIA'S latest move to gain another toehold in the international oil industry has come in Ethiopia where the Russians have agreed to lend the money needed to build a refinery and have taken the construction contract.

In return, the Russians apparently will be assured a supply contract for the 5,000-bbl. daily plant and according to all reports, Ethiopia has also agreed to form a joint Soviet-Ethiopian marketing company to sell the products.

This would mean that Royal Dutch Shell and British Petroleum, primary marketers in Ethiopia, would be frozen out.

Details of the agreement were obscure last week, but reports from East Africa indicate the agreement was signed in spite of last minute British protests to the terms. The refinery will be built by a Soviet company and with Soviet money near the Ethiopian port of Ass'ab on the Red Sea.

. . . and Satellites

THE RUSSIANS will step up shipments of both crude and products sharply under terms of new 5-year trade agreements signed with Soviet satellites in Eastern Europe.

The USSR has agreed to ship Poland 8.5 million metric tons (about 60 million barrels) of crude and 7.7 million metric tons (roughly 58 million barrels) of products during the 1961-65 period.

If these shipments are maintained it would average about 65,000 bbl. daily over the 5-year period. In 1958, the last year for which complete figures are available, Russia shipped Poland a little more than 1.5 million metric tons of both crude and products, or just about 30,000 bbl. daily.

The Czech agreement calls for the Soviets to deliver 22 million metric tons of crude by 1965. The Russian exports to the Czechs are expected to reach 5,250,000 tons a year, or about 105,000 bbl. daily by 1965. This compares with less than 1,400,000 tons, or only about 28,000 bbl. daily, in 1958.

World Output Drops

• But the increase in Middle East production keeps free world rates near record levels.

A 14% INCREASE in Middle East oil production during the first quarter of this year kept free world production near record levels in March with the only declines in output showing up in the Western Hemisphere.

If the Middle East oil-producing countries maintain the first quarter production rate for all of 1960, oil output from this flush production area could average 5,000,000 bbl. daily. This figure, more than the free world produced as recently as 1936, is not likely unless world oil demand continues to increase.

Free World production in March dropped slightly below February, but it still was well over 10 million barrels daily for producing areas outside the U. S.

Sliding production in the U. S., Canada, and Venezuela accounted for the Western Hemisphere drop, but every other producing region in the world showed healthy increases. A 148,000-bbl. daily increase in Kuwait helped offset slight drops in other Middle Eastern producing nations while the Far East and Africa continued to show new gains.

TREND OVER THE LAST YEAR

	Western Hemisphere less U.S.	Middle East	Total free world outside U.S.
1959			
March	4,245.6	4,654.7	9,726.6
April	3,910.4	4,646.4	9,396.5
May	3,773.6	4,571.4	9,181.0
June	4,111.5	4,467.9	9,428.7
July	3,914.8	4,532.5	9,293.2
August	3,862.1	4,659.7	9,344.9
September	3,887.5	4,635.5	9,396.4
October	4,069.6	4,688.2	9,629.8
November	4,123.2	4,820.7	9,877.9
December	4,218.5	4,682.0	9,861.5
1960			
January	4,316.5	5,065.3	10,334.7
February	4,359.5	5,066.5	10,380.3
March	4,156.4	5,146.3	10,346.8

World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	Mar. 1960	Feb. 1960	Mar. 1959
Western Hemisphere			
Argentina	138.9	139.5	121.3
Bolivia	9.1	9.1	8.3
Brazil	76.0	76.0	53.1
Canada	552.0	575.0	511.8
Chile	18.8	18.8	16.6
Colombia	156.9	156.9	140.8
Cuba	0.5	0.5	0.6
Ecuador	7.8	7.8	7.8
Mexico	263.5	265.0	268.8
Peru	47.2	47.2	47.6
Trinidad	119.9	117.7	109.4
Venezuela	2,765.8	2,946.0	2,959.5
Total	4,156.4	4,359.5	4,245.6
Europe			
Austria	45.8	45.3	45.4
France	35.8	36.9	28.7
West Germany	105.1	101.4	94.6
Italy	31.0	30.8	34.1
Netherlands	34.9	33.9	34.4
United Kingdom	1.7	1.7	1.3
Yugoslavia	13.9	12.1	10.7
Total	268.2	262.1	249.2
Middle East			
Bahrain	45.1	45.0	45.1
Iran*	1,071.0	1,088.0	977.0
Iraq†	938.3	920.0	792.3
Israel	2.0	2.0	2.0
Kuwait	1,600.2	1,452.0	1,384.2
Neutral Zone	128.0	122.0	110.5
Qatar	179.5	184.4	177.7
Saudi Arabia	1,175.3	1,245.8	1,159.5
Turkey	6.9	7.3	6.4
Total	5,146.3	5,066.5	4,654.7

Country—	Mar. 1960	Feb. 1960	Mar. 1959
Other Asia			
British Borneo	110.0	110.0	107.0
Burma	10.5	10.5	9.3
India	8.5	8.5	8.5
Indonesia	405.3	325.0	340.0
Japan	8.9	9.0	7.3
New Guinea	4.3	4.3	4.9
Pakistan	5.9	5.9	5.9
Total	553.4	573.2	482.9
Africa			
Algeria	122.8	127.4	11.7
Angola	0.9	0.9	0.8
Egypt	59.2	59.3	60.0
Gabon	15.5	12.1	13.3
Morocco	2.1	2.2	1.8
Nigeria	22.0	17.1	6.6
Total	222.5	219.0	94.2
Free World			
Foreign	10,346.8	10,380.3	9,726.6
United States	7,128.0	7,241.0	7,188.0
Total	17,474.8	17,621.3	16,914.6
Communist Countries in Soviet Orbit			
Romania	235.0	235.0	235.0
Russia	2,843.0	2,843.0	2,420.0
Others	100.0	100.0	60.0
Total	3,178.0	3,178.0	2,715.0
WORLD TOTAL	**20,652.8**	**20,799.3**	**19,629.6**

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking. *Includes estimated 6,000 bbl. daily from Naft-i-Shah field not operated by Consortium companies. †Includes estimated 3,500 bbl. daily from Naft Khaneh field, operated by Iraq Government.

Ruhr Valley Pipeline Makes a Big Impact

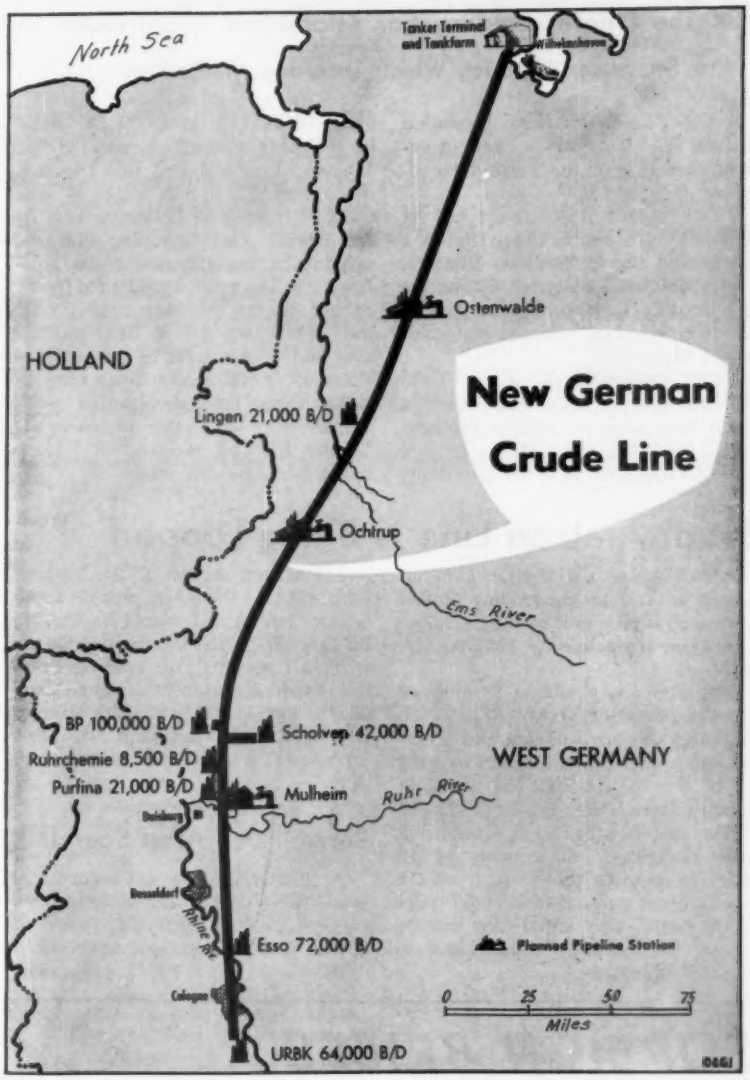
- A 50% capacity jump is scheduled in 1960, its second year of operation.

A NEW crude carrying system from Wilhelmshaven to the Ruhr is quickly changing the face of the West German oil industry.

The 245-mile 28-in. pipeline carried almost one-third of all crude imported into the country last year, with deliveries averaging 5.3 million tons, or about 106,000 bbl. daily. This year, throughput will increase to 9 million tons, or about 180,000 bbl. daily.

The capacity of the line is to be increased in 1960 by 50% to 300,000 bbl. daily. The line will eventually carry about 500,000 bbl. daily.

An immediate result of the first year's operation was to make Wilhelmshaven the biggest oil port in the country, taking the lead away from Hamburg. The former naval center is now one of the most important oil ports in Europe. It is one of the three capable of handling 100,000-ton tankers. The other two are Rotterdam and Le Havre.



Joint ownership . . . The pipeline is owned jointly by six refining companies, five of which already are taking feed from the system. A seventh company is taking supplies from the line, but has no ownership.

Esso A. G. is the chief participant, with 47.2% interest. The line supplies its new 72,000-bbl. refinery at Cologne. British Petroleum is the second ranking owner, with 26.3%. The system will supply the company's 100,000-bbl. refinery opening this summer at Dinslaken.

Purfina Mineraloelraffinerie (Petrofina) has 8.3% interest in the line. The company has a 21,000-bbl. refinery at Duisburg, which will be expanded to 60,000 bbl. later. Schloven-Chemie, with a 42,000-bbl. plant at Gelsenkirchen, has 7.7% interest. Union Rheinische Braunkohlen Kraftstff, with a 64,000-bbl. refinery at Wesseling, has 6.8% interest. Ruhrchemie, with a 8,500 bbl. plant at Oberhausen, has 3.7% interest.

Gewerkschaft Erdoel - Raffinerie, which has no interest in the line, takes supplies for its 21,000-bbl. refinery at Lingen. The company is expanding its plant to 50,000 bbl.

One of the seven plants served by the Wilhelmshaven-Ruhr system also will take supplies from the Rotterdam-Ruhr pipeline now under construction. This is the Union Rheinische refinery at Wesseling.

The pipeline . . . The pipeline has already cost $60-million, and another $16-million will be required to expand it to full capacity.

Ruhrgas designed the system, and 65,000-tons of pipe, from ⅓ to ½-in. wall thickness, was supplied by Phoenix and Mannesmann-Hoesch. Each section was tested at twice the expected operating pressure.

The route is comparatively flat, with a maximum elevation of 400 ft. above sea level at a point south of Mulheim. But there are 206 highway, and 58 railroad crossings, and right-of-way permission was acquired from 2,300 property owners. Fifteen water crossings include the Rhine and Ems Rivers, and Weser-Ems and Lippe-Side Canals. The pipe is covered with bituminous coating, cathodically protected, and buried at 3 ft.

There is only one pumping station so far, at Wilhelmshaven. Pumps start the crude moving southward at 850 to 1,000 psi. Deliveries to refineries are controlled from the Wilhelmshaven control room. Communications are carried on over the multichannel system of the regular telephone service. Signalling gear was designed by Siemens.

Three more pumping stations will be built later. They will be located at Ostenwalde, Ochtrup, and Mulheim.

The import terminal of the new pipeline is a first class tanker port and can handle 100,000-ton tankers at low tide.

CFP to Market in Australia

- **The French company has established a distributor in the State of Victoria, which includes Melbourne.**

A CO-OWNER of Hassi Messaoud oil field is pushing for markets in another new part of the Eastern Hemisphere, this time in Australia.

Cie. Francaise des Petroles has set up Total Oil Products (Australia) as a distributor in the State of Victoria, Australia. It has budgeted $9 million to kick off its marketing program in the state, which includes the important city of Melbourne.

CFP's marketing subsidiary, Total International, recently tied down a crude sales contract with a Japanese firm, Asia Oil Co. Deliveries are scheduled to start at 4,500 bbl. daily, and will increase to 8,000 bbl. daily in the near future. A loan to the Japanese firm was tied into the deal (OGJ, Feb. 22, p. 86).

CFP's moves in countries east of the Persian Gulf coincide with the opening of the 420-mile crude pipeline from Hassi Messaoud field in the Sahara to the Mediterranean. CFP has 23¾% interest in Iraqi production and 6% interest in Iranian production. Oil moved to Japan or Australia from Iraq or Iranian ports would help take the pressure off Middle East oil replaced in Europe by Hassi Messaoud crude.

Saudi Arabian Line Is Being Looped

ARABIAN American Oil Co. has started an $11 million looping project to expand throughput of the Safaniya-Ras Tanura pipeline by 285,000 bbl. daily.

The company is adding 73 miles of 30-in. pipe to the system to push up deliveries of both Safaniya and Khursaniyah crude. Present capacity of the 22-in. line is 190,000 bbl. daily of Safaniya crude.

The first 22-mile, 30-in. section has been completed. It consists of 15 miles of pipe to the south of the Khursaniyah pump station and 7 miles to the north. This initial loop will increase the Safaniya throughput to 215,000 bbl. daily.

The second section of the big-inch loop will take the 30-in. pipe on south to Ras Tanura and should be finished by October. When this portion of the work is completed, the existing 22-in. line from Khursaniyah's pump station to Ras Tanura will carry the output of Khursaniyah field. The new 30-in. section will move Safaniya output.

Burmah Deep Test Spudded

A SECOND deep test aimed at establishing deeper and more prolific oil production at Burmah's 58-year-old Chauk field was spudded last week.

Burma Oil Co. (1954), Ltd., abandoned an 8,200-ft. test in April in the same area after testing several sands. The company says those tests gave indications that the sands may be productive down dip.

Burmah has produced more than 308 million barrels of oil in its oil history but all from shallow depths of less than 4,000 ft. Previous efforts to establish deeper production in the Chauk region have been hampered by extremely high pressures.

The company moved a new, modernized rig into the country last year to try and overcome previous mechanical problems in the deeper drilling program.

IPC Drops Concession Talks

TWO sheikhdoms with a concession to offer in southern Arabia are looking elsewhere for bidders, following a breakdown in talks with an affiliate of Iraq Petroleum Co.

Qu'Aiti and Kathiri states, located in eastern Aden protectorate, plan to advertise for bidders for a concession covering the Thamud area.

Thamud lies in the northern Hadramaut Desert in an area claimed by both Qu'Aiti and Kathiri. Petroleum Concessions, Ltd., an IPC affiliate, had held a concession for more than 20 years over the entire protectorate. But these rights mean little, aside from the right to carry on surface work, unless the company reaches agreements with independent governments in the area (OGJ, Feb. 8, p. 76).

Two American partners in IPC, Jersey Standard and Mobil, withdrew their participation from the Qu'Aiti and Kathiri negotiations before the talks were terminated.

FOREIGN BRIEFS . . .

Mitsui Petrochemical has asked the Japanese government to allocate enough foreign exchange to enable it to build an $18 million plant in a 50-50 partnership with Du Pont. The plant would make 18,000 tons a year of high-pressure polyethylene.

A 40,000-metric-ton urea plant will be built by Montecatini and Uniao Fabril do Azoto at Labradio, Portugal, near the town of Barreiro on the Tagus River. The plant will use the Fauser - Montecatini process and is being engineered by M. W. Kellogg Co.

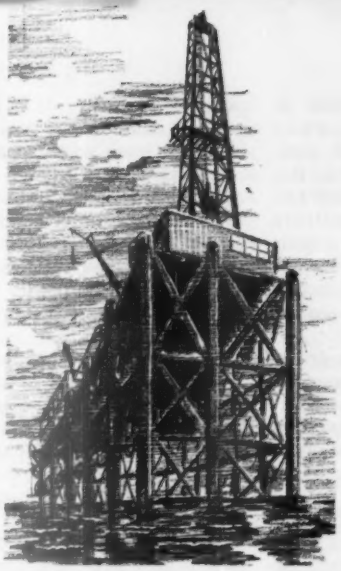
A Unifining-Platforming unit has gone on stream at Ruhrchemie A.G.'s Oberhausen, Germany, refinery. Platformate from the 2,000-bbl. Platforming unit is blended with light cracked gasoline to produce a 94-95 octane gasoline. The units were designed and licensed by Universal Oil Products Co.

A unitization program for a natural-gas field straddling the Iron Curtain is being worked out by Austria and Czechoslovakia. Negotiations are in progress for an agreement under which each country will develop and produce gas from its own half of Zwerndorf field at a specified rate. A joint commission composed of geologists and other experts is trying to determine field limits, reserves, and other pertinent data.

The Sui-Multan natural-gas pipeline system may be extended further into northern West Pakistan. Pakistan Industrial Development Corp. is considering the project and has ordered a technical survey.

Three marketers in South Vietnam—Stanvac, Shell, and Caltex—are considering a refinery project in the country in the face of possible entry by a rival group. Sterling Oil reportedly backed by Summit Corp., Phillips Petroleum, and American Independent Oil, is planning to enter the local market and may offer to build processing facilities.

Shell Co. of Singapore will build a new 20,000-bbl. daily refinery on Pulau Bukom Island, 4 miles south of Singapore. The company already has Southeast Asia's largest storage, blending, and distribution facilities on the island.



OFFSHORE ACTIVITY

A SPECIAL SECTION

Drilling, production, and pipelining operations are now going on in shallow waters all over the world. This Journal roundup points up the highlights of the most significant activity. Paul Swain, international editor, brings us up to date on activities outside the United States. Ed McGhee, drilling editor, summarizes the cost and activity pictures for the Gulf Coast. Dave Stormont, Journal staff, reports the latest on underwater completions. Articles on Great Lakes activity, and control of submarine pipelines complete this special report.

Continental shelves busy as

World-wide offshore areas begin yielding their promised riches

BY PAUL SWAIN
International Editor

THE GULF OF MEXICO has been the glamor girl of marine exploration and drilling in recent years, but she is beginning to share her limelight with other waters across the globe.

Respectable oil discoveries have been made in widely separated areas of the Persian Gulf and under this fetid body lies the world's largest proved oil field. Six companies already have drilling under way here in the waters which are both a link between and a barrier separating the Middle East's oil-producing countries.

Four thousand miles farther east, a Japanese oil firm has found off Honshu Island an oil field it believes to stretch 37 miles.

Back in the Western Hemisphere the Gulf of Paria between Venezuela and Trinidad is an offshore-oil hotspot claiming a distinction. Every known drilling technique for overwater drilling is being tried here. Stationary platforms have found commercial oil on both sides of the international boundary that divides the gulf. An oil field has been found by a rig mounted on a floating barge, the first such discovery in the world. Mobile, submersible-type platforms are drilling here. And, on both sides of the boundary big multiple-well platforms are being used in development drilling.

Across the Atlantic, Shell is making active preparations to spud a well in the North Sea off Holland.

And the water in half-dozen more continental-shelf areas is being churned today by oil-seeking drillers.

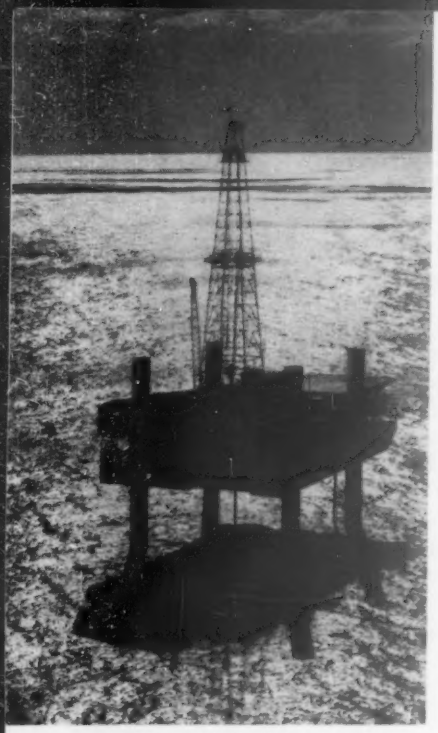
Persian Gulf

Five now, another coming. The very bigness of Gulf of Mexico operations in terms of money and companies involved has overshadowed operations in the Persian Gulf, but this is changing. There are five modern mobile drilling barges at work in the Persian Gulf, and a sixth is being built, almost certainly to work here. There are two fixed-platform drilling operations under way and at least one more will be added this year.

In addition to Arabian American Oil Co.'s big 10-year-old Safaniya oil field, major field discoveries have been made by the Japanese off the Neutral Zone, by a French-British combine off the Trucial Coast, by Aramco at Manifa off Saudi Arabia, and there is every indication that both the Italians and Pan American will have success off Iran.

Aramco is the Persian Gulf pioneer, and Safaniya establishes the company as the leader for at least the foreseeable future. In addition the company is now developing a second offshore field at Manifa, south of Safaniya along the Saudi Arabian coastline.

Safaniya, discovered in 1951 with a well drilled onshore, now has almost 72,000 proved surface acres and a total of 32 wells. The field produces 27°-gravity crude from the country's only Cretaceous sandstone pay from



PERSIAN GULF ACTIVITY is typified by the drilling barge, Adma Enterprise. World's largest proved oil field is located here, and six oil companies have drilling under way.

an average depth of 5,560 ft.

Potential of Safaniya is barely tapped at the present. The 22-in. pipeline linking the offshore field to Ras Tanura has a capacity of 175,000 bbl. daily. Today 15 of the fields wells are shut in, there is no active drilling program, and the pipeline moves less than 60,000 bbl. of the production because of depressed demand for the oil.

All the Safaniya wells were drilled from fixed platforms using Aramco's veteran tender the "Queen Mary" which the company bought from Creole Petroleum in Venezuela and towed to the drilling site from Lake Maracaibo.

Manifa was discovered in 1957 by a wildcat drilled on a seismic prospect. Thus far, the proved area extends more than 13 miles with six wells completed in the 7,900-ft. Lower Cretaceous limestone. The field is not currently being produced.

Manifa is being drilled with a small LeTourneau three-legged mobile platform which was towed to the Persian Gulf from Vicksburg, Miss., 2 years ago. The 899-ton barge is equipped with a 136-ft. derrick and the rig is rated to 13,000 ft. It is in 65 ft. of water 8 miles off the Saudi coast and about 20 miles south of Safaniya.

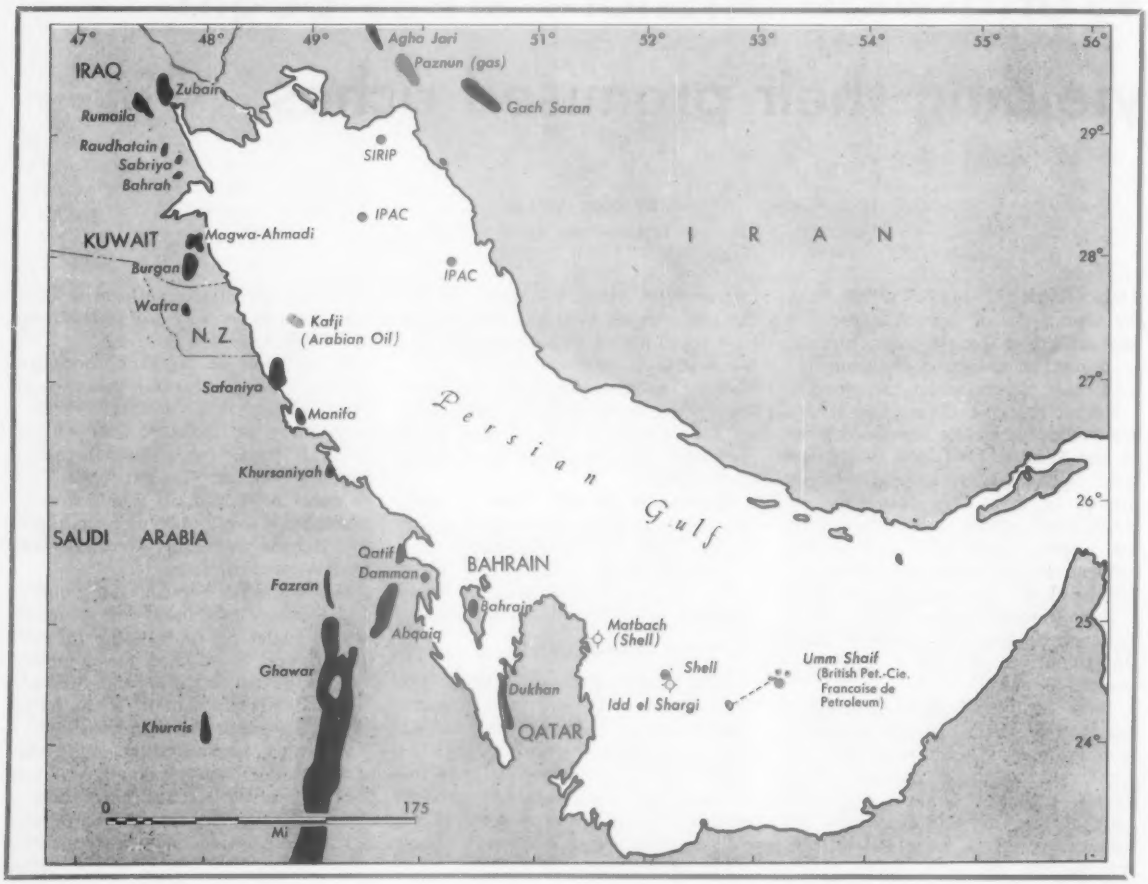
Arabian Oil Co. The Japanese-owned company which broke the 50-50 profit-sharing formula to get drilling rights off the Neutral Zone has furnished the drama for the Persian Gulf's marine operation this past year.

The Japanese company found a Safaniya-type crude in its first well about 25 miles offshore and about the same distance to the northeast of Safaniya. The well was in 102 ft. of water. In mid-April, a 3-mile stepout to the southwest also proved to be productive.

The 1 Kafji was drilled from a LeTourneau mobile platform owned by Reading & Bates, Tulsa, and served by a tender. Drilling contractor is International Drilling Co.

The 1 Kafji blew out and caught fire last July when it hit a high-pressure gas zone at 1,500 ft. shortly after the drilling began. The well blew wild for 9 days and destroyed much of the drilling equipment without doing major damage to the barge. Operations

FIVE MODERN MOBILE BARGES are at work in the Persian Gulf, with a sixth under way for work there.



were resumed after a 4-month delay.

In February the Japanese had their first producer. The well was completed at 5,476 ft. after finding both the upper and lower Burgan productive. All reports indicate the discovery found 700 ft. of pay with a net pay thickness of 500 ft. Initial tests flowed more than 6,000 bbl. daily on a ¾-in. choke. The 6,000-bbl.-daily figure revealed by the Japanese firm is generally conceded to be very conservative.

The second well was completed in the same pay and with a similar flow.

The Japanese company plans to drill at least 8 more wells this year and hopes to have a total of 43 completed by 1964. To help in the intensified drilling program, the company has contracted with Seacat Drilling Co. for a second rig to be operated from a fixed platform by a tender. The second rig is due in June.

Contracts have already been let for dredging, wharf construction, and other facilities for shore installations to handle production at Ras al Khafji, 75 miles south of Kuwait town.

SIRIP. There is now every indication that the joint Italian-Iranian offshore operation has been as successful (though on a smaller scale) as the Japanese firm.

Soc. Italo-Iraniana dei Petroli (SIRIP) was formed 3 years ago when Enrico Mattei, dynamic head of Italy's government-owned Ente Nazionale Idrocarburi, moved into Iran and offered the country a 50-50 partnership in exchange for concessions.

SIRIP's first well offshore is being drilled from a permanent platform in 18 ft. of water about 6 miles off the coast of Iran on a 2,160-sq.-mile concession at the head of the Persian Gulf. At last report, logs were being run at 9,600 ft. in the well.

There has been no official confirmation of the discovery, but Rome rumors of oil in the well jibe very closely with information already revealed by National Iranian Oil Co. on drilling progress. Reports indicate the well tested at the rate of 3,500 bbl. daily from an unidentified pay found at 7,550 ft. NIOC has said that 7-in. casing was landed at 7,455 ft. in preparation for testing. The well is still drilling.

The operating company, SIRIP, is owned equally by NIOC, the national company, and Mattei's ENI. NIOC is a full, but nonpaying partner in the operation as far as exploration is concerned. Once commercial production is established, ENI will split its profits first with NIOC and then with the government. NIOC will be required to participate in development costs.

IPAC. When Pan American International (Indiana Standard) moved into the Middle East 3 years ago it opened with blue chips. If the company is yet ready to win a pot, it has not so indicated.

Pan American's agreement with Iran for a 6,180-sq.-mile offshore block just to the south of SIRIP is similar to the deal made by the Italians. In addition Pan Am gave the Iranians a $25 million bonus for the tract and agreed to spend $82 million on exploration within 12 years.

The first well being drilled by the joint company, Iran-Pan American Co., is drilling ahead below 13,000 ft. after an extensive fishing job. It is apparently headed for the originally projected depth of 16,000 ft. Latest reports indicate the bit was in Lower Cretaceous at 12,000-ft.-plus depth. Shows of oil were found below 11,500 ft. but the company has made no evaluation.

The well is being drilled in 129 ft. of water about 80 miles offshore. Equipment is standard DeLong-type mobile barge equipped with an Ideco E-2500 rig. The barge was towed to Iran from Orange, Tex., and another 125 ft. of "leg" added after the barge made the trip. Seacat Marine Drilling Co. is the contractor on the well.

IPAC revealed plans for a second test last April. It will be about 21 miles south of Kharg Island where the Iranian consortium is now building a big new crude-loading terminal to be served by Gach Saran field in Iran. The new test will be drilled in 142 ft. of water from a fixed platform served by a McDermot tender.

Shell. Officials of the Royal Dutch-Shell Group faced a dilemma more than 3 years ago when a freak Persian Gulf current damaged a 1,900-ton drilling platform beyond repair and cost several lives. The group had $21 million already invested in two dry holes off Qatar and with its drilling equipment a total loss, the whole exploration program hung in the balance.

Shell's answer 3 years later is the $5 million "Seashell," a Netherlands-built mobile platform that is now putting down Shell Co. of Qatar's third wildcat in the Persian Gulf.

The 209-by-105-ft. platform has eight legs supporting its pontoon hull. It carries a derrick and drilling equipment capable of drilling a 17,000-ft. test.

Shell's previous efforts to find oil in the subsea area east of Qatar represented the first drilling efforts in this region of the Persian Gulf. The company's two previous wells were notable failures.

The first test, 1 Matbach, was the first wholly marine drilling operation in the Eastern Hemisphere. Spudded in February 1955, the test was abandoned as a dry hole the following August at 6,706 ft. in 32 ft. of water 35 miles north of Doha and 5 miles off the east coast of Qatar.

The second Shell test, 1 Idd el Shargi, was no better. The well, 50 miles east of Doha and 20 miles south of Halul Island, tested oil shows found in the Upper Jurassic Arab zone, but produced salt water with only small amounts of oil. It was abandoned as a dry hole at 11,883 ft. in the Lower Triassic in December 1956.

It was on the move from the location to a third well site, that Shell lost its original barge.

Abu Dhabi Marine Areas, Ltd. A joint French-British venture has already established the Persian Gulf's third commercial oil field at Umm Shaif, north of the Trucial Coast and to the east of the area in which the Shell company is drilling.

Abu Dhabi Marine Areas got its 12,000-sq.-mile subsea concession from the Sheikh of Abu Dhabi, one of the Trucial protectorates. Its ownership is split on a 2-to-1 basis between British Petroleum Co. and Cie. Francaise de Petrole, with the British holding the big end.

The company now has three producing wells at its undersea field and is drilling a fourth from the Adma Enterprise, a mobile drilling barge built specially for use in this region.

The 1 Umm Shaif was completed late in 1958 flowing 2,400 bbl. daily of 40°-gravity crude from Lower Cretaceous Shuaiba or Thaman limestone at about 5,500 ft.

The second Umm Shaif well was disappointing to the company, but is still regarded as commercial. The third, completed in the Arej zone at 9,600 ft., prompted the company to begin full-scale development.

The company has never revealed specific results of the third well, but based on what it found, it began building terminal facilities on tiny Das Island—20 miles to the west—to handle production from Umm Shaif. The field will be linked to Das by a 20-mile submarine pipeline.

The new terminal site is pretty desolate even by Middle East standards. Fifty miles off the coast, it was uninhabited before the company built its base camp there for drilling operations. As a crude terminal it will have a competitive advantage over crude-loading ports to the north in that it could shave several hundred miles off tanker voyages into the Persian Gulf.

ANOTHER MARINE HOT SPOT is the Gulf of Paria, rivaling the Gulf of Mexico and the Persian Gulf.

THIRTY-SIX-WELL PLATFORM in Gulf of Paria is operated by Texaco. Derrick drills six holes from one position, then skids itself ahead to new position to drill six more.

Gulf of Paria

The Gulf of Paria has long been in the running as a first-class rival for both the Perisan Gulf and the Gulf of Mexico as a marine-drilling hot spot.

While results in Paria have not been spectacular, the companies involved have invested millions of dollars so far and they're making every effort to recoup their money with commercial oil operations.

The Trinidad side of the gulf so far has the most to show for this effort and investment.

Texaco offshore. One of the big multiwell platforms was built by Texaco Trinidad almost 2 years ago in 68 ft. of water 1½ miles off the Brighton terminal pier. So far the company has completed 19 wells on the big platform and is drilling on the twentieth. The company produces about 3,200 bbl. daily from the wells.

The 52-by-157-ft. drilling platform is supported by fifty 36-in. concrete piles. It mounts a derrick which drills

six holes from one position and then is skidded to another spot for another six. The platform is designed to accommodate a total of 36 wells.

This development is a natural outgrowth of Texaco's slant-hole drilling operation from onshore in the Brighton area.

The company recently let contracts for three more single-well drilling operations. All will be drilled from platforms.

Soldado field. The first established marine oil production in the Gulf of Paria was at Soldado, 14 miles west of Trinidad's Point Fortin jetty and only 7½ miles east of the international boundary.

Trinidad Northern Areas, Ltd., owned by British Petroleum, Trinidad Shell, and Texaco Trinidad, spudded its first well at midyear in 1954 and then drilled two more deviated holes from the same platform before converting it to a production platform.

TNA spent almost $2 million on geophysical surveys and equipment before the first well was spudded. Today the three-company combine is beginning to see some cash results of its investment.

In the last 9 months, the operation has completed seven wells, such as the initial Soldado tests, producing from the Miocene at 4,000 to 4,800 ft.

The three-company operation is now producing about 14,000 bbl. daily from the offshore field.

In addition to Soldado field, a mobile drilling barge owned by TNA has apparently established a new productive area to the north of Soldado on acreage controlled by Trinidad Petroleum Development, a wholly owned subsidiary of British Petroleum.

The BP subsidiary has a strip of acreage extending westward from Trinidad to the international boundary which separates the TNA offshore region in the south from that controlled by Dominion Oil Co. in the north.

Two wells have been drilled on this tract, both apparently commercial producers. British Petroleum will say nothing officially about either 1 North Marine or the No. 2 which will drill 5 miles to the west.

Both wells were drilled with a 2,200-ton mobile drilling barge built for TNA in Germany.

Kern Trinidad. An offshore-drilling-operation location between Soldado and Domoil in the north has almost become a sleeper because it is located closer inshore.

Kern Trinidad Oil Fields is already under way on a 12-well drilling program on a 5,700-acre offshore tract lying just north of Point Fortin.

The first well, 5,000 ft. offshore in Guapo Bay, is being drilled with the Nola III, the Zapata Offshore Co. barge which drills over the side of a floating vessel.

This operation follows two successful deviated wells which the company completed from shore-based rigs. Chriatiana Oil Corp., a California company, has a 15% interest in the operation. Kern Trinidad Oil is a subsidiary of Rio Tinto Co.

Dominion Oil. The "floating drilling" veteran of the Gulf of Paria has been able to boast of about as much success as those companies using more conventional drilling methods.

Dominion Oil Co., a subsidiary of Standard Oil of California, drilled three dry wildcat holes in its big block of marine acreage before the company hit with 1 South Domoil. Two successful offsets have been drilled in the field discovery and a fourth is now drilling.

Thus, Dominion can claim the world's first oil discovery from a nonstationary drilling device.

The 1 South Domoil was drilled in 93 ft. of water about 30 miles southwest of Port of Spain and 20 miles to the north of Soldado field. Besides claiming the first discovery from a floating barge, the well is also the deepest ever drilled with this type of equipment. The hole reached a total depth of 11,337 ft.

The discovery climaxed a drilling program started on the basis of successful core-hole drilling off the coast of California. Offshore Co., Baton Rouge, is the contractor for the Paria operation. The company is using a 240-by-72-ft. barge carrying a National 55 rig and Shaffer submarine drilling equipment. Drilling is carried on through a 12-ft.-diameter well cut in the center of the barge.

The outfit has been drilling conventional-size holes with 4½-in. drill pipe.

South Domoil wells tested at rates from 1,000 to 1,700 bbl. daily. The discovery was completed from perforations in a sand found at 9,340-70 ft. No. 2 was perforated between 8,474-9,370 ft. just ¼-mile south of the discovery. The third well was drilled ½ mile east of No. 2, and the fourth is now drilling slightly to the south southwest of No. 2.

The big problem which Dominion Oil has not yet been able to whip is completing a discovery from its floating barge.

The Venezuelan side. Paria Operations, Inc., the five-company combine which paid $100 million in bonuses for a 151,000-acre underwater concession, is still a long way from a payout in its operation.

It has established potentially commercial production in five wells drilled so far, but test rates have admittedly been a disappointment to everyone concerned.

The discovery, POSA 112-1, was drilled from a permanent platform 10 miles to the west of Trinidad's offshore Soldado field. It tested about 1,500 bbl. daily of 20°-gravity crude from two sands found between 4,000 and 4,500 ft.

After the discovery, Paria Operations drilled four widely separated dry holes at locations staked in the central area of its big block of acreage. Then the combine went back to the initial POSA location where it has drilled 3 more wells from a 27-well platform prefabricated in Houston and towed to the location.

One of three directional holes logged about 140 ft. of sand and the other 250 ft. In each case they were different pays from the discovery and the first offset.

One tested 1,116 bbl. daily of 14°-gravity crude from a 75-ft. pay section and the other flowed at the rate of about 300 bbl. daily.

Drilling from the multiwell platform is being done by Loffland Brothers.

Paria Operations is also operating one wildcat rig in the same vicinity. This rig, drilling from the 1 Nola, a converted YF barge which drills over the side, recently made a discovery 1¼ miles south of the multiwell platform.

The new well, 117-1, tested at the rate of about 20 bbl. an hour from a pay below 5,500 ft. The floating drilling equipment has moved off to a new location, 115-2, spotted 1½ miles due west of the 117 and about 2 miles southwest of the big permanent platform.

The company plans to erect a small caisson-type production platform at 117-1.

Paria Operations is split five ways among American oil-company owners. Ohio, Texaco, and Continental each own a 25% interest in the operation. Cities Service has 16⅔% and Richfield Oil has the other 8⅓%.

The only other drilling done on the Venezuelan side of the Gulf of Paria met with no success. Pan Venezuelan Petroleum (Indiana Standard) abandoned its GOPA-1 as a dry hole at 6,890 ft. early this year.

Both Cia. Shell de Venezuela and Atlantic Refining have tracts under concession on the Venezuelan side of Paria, but neither has yet begun a drilling operation in that area.

OFFSHORE WORK in Sea of Japan is typified by this drilling from a platform a little over 1 mile from land. Japan Exploration Co. assembled the platform for wildcatting work.

Sea of Japan

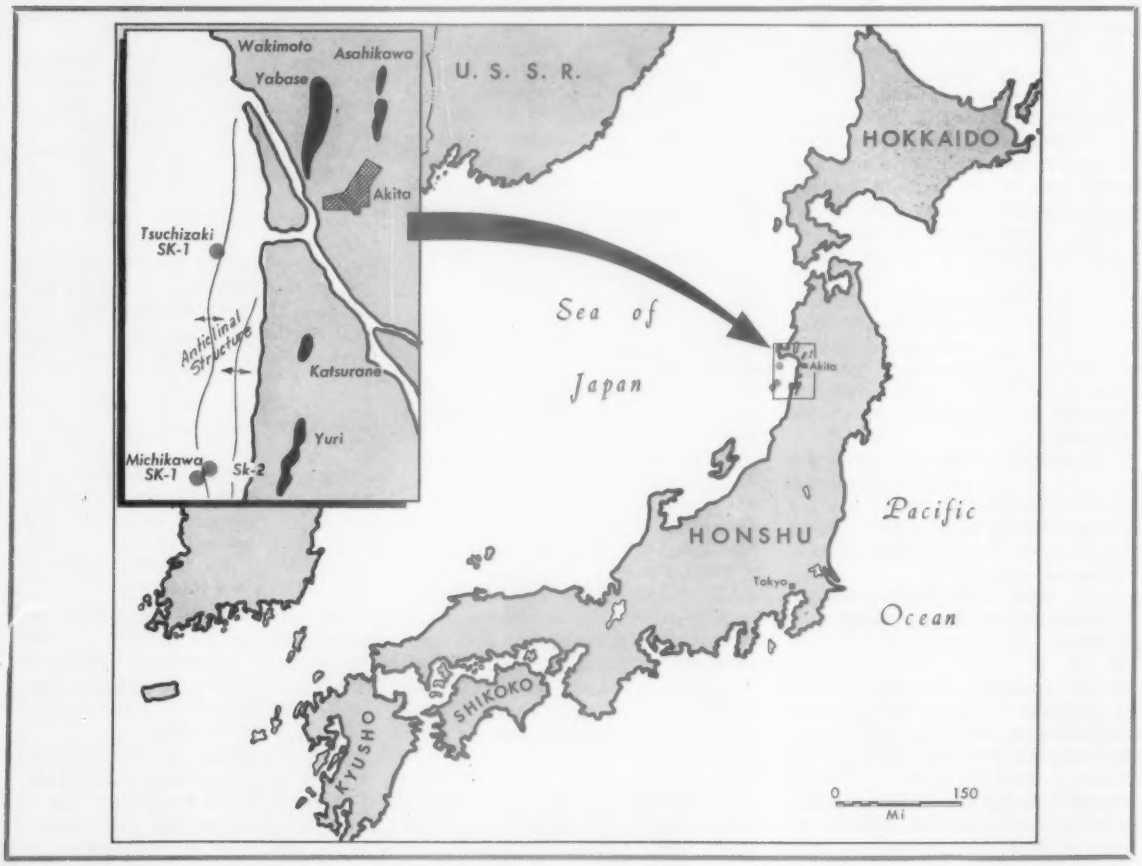
Typhoons have not stopped Japan Petroleum Exploration Co., Ltd., (Sekiyu Shigen Kaihatsu K.K.) from finding an important field off the Japanese home isle of Honshu. Despite a series of the devastating storms last fall, the company completed a producing well 1.4 miles off Tsuchizaki, Akita Prefecture.

The 4,767-ft. tests found a promising oil zone between 1,780 and 1,920 ft. (upper Katsurane sand). The zone made 1,900 bbl. of oil with 350 M.c.f. of gas per day through 1½-in. choke. Good oil and gas shows were also found at 3,410 to 4,010 ft. (Yabase No. 7 zone) and 4,280 to 4,350 ft. (Yabase No. 8 zone).

This well, called the 1 SK, is the third drilled by the Japanese company. The first two failed to find production; they are in the same area.

Drilling is done with the $3,000,000 LeTourneau-type platform, the "Haku-Ryu" (White Dragon). This 4,300-ton vessel spudded its first well in October 1958. Plans call for at least four more offshore wells this year.

THREE WELLS have been drilled off the Japanese home isle of Honshu, but only one found production.



INCREASED ACTIVITY of offshore mobile units such as this one (Offshore Co.'s Unit 55) mean that . . .

Storm warnings are coming down

for Gulf of Mexico offshore drillers

BY ED McGHEE
Drilling Editor

THE PAST 3 YEARS were just one long spell of rough economic weather for many of the companies operating in the Gulf of Mexico. High costs and low allowables blew away profits like spray from the waves.

While the waters are still rough, the offshore operators now indicate they sight smoother sailing ahead. These companies have recently:

- Bid record sums for unproved offshore acreage.
- Drilled new wells this year at a near-record pace.
- Increased their demand for offshore-drilling rigs enough to substantially raise the rental prices for some of these units.

How are the Gulf of Mexico producers steering themselves out of their private tempest? By good seamanship—or, rather, by good offshore engineering. By operating cheaper and smarter when the forces of time and nature offered no relief. One longtime offshore operator estimates that he now gets 10 to 20% more work per unit from the drilling rigs, construction barges, and other equipment.

One dark cloud still threatens: a further reduction of per well allowable production. Most producers fear that another stiff cut in oil allowable offshore, coming after the long series of such cuts since 1955, could wreck their chance of recovering their investment in reasonable time.

Cheaper wells. All pleas for relief of Gulf of Mexico operators through higher allowables have been fruitless. When it became apparent that allowables wouldn't be raised, the producers had to invent new ways to cut their costs if they were to continue developing the underwater reserves.

Mostly, the cost-cutting labors take two channels: cutting drilling time on each well and making more multiple completions at less cost. The producers seem to be succeeding nobly on both counts.

Take the issue of faster drilling. Several times in the past year, drilling contractors working for Gulf Oil Corp. offshore have drilled wells to 10,000 ft. in less than 5 days. No dry-land producer or contractor has approached that speed.

Gulf isn't alone in getting outstanding drilling speeds; other companies have posted almost equally fast records. Secret is good drilling practice: high weights on bit and extra-good hydraulics.

The offshore producers have often found a saving in giving more freedom to their drilling contractors. Footage drilling contracts have been used offshore, but until recently, directionally drilled wells (probably 75% of all offshore holes) were drilled on day-work rates. Now, contractors take directional holes on footage rates; they even provide the directional tools and operators necessary. Result has been faster, cheaper wells.

Take the issue of multiple completions. Methods for making dual, triple, quadruple, and even quintuple completions have improved steadily. With today's equipment, all tubing and packers for a multiple completion can be run simultaneously and without strapping the pipe together. Testimony to the efficiency of these operations is

Sinclair Oil & Gas Co.'s first-ever quintuple completion, announced just 2 months back. Only 56 hours' rig time was required to run six packers and 33,100 ft. of tubing into this well.

Many say that the opportunity to make multiple completions has been the salvation of offshore oil. Each completion zone gets a full well allowable. The offshore producers live in constant fear that state regulatory bodies may tamper with this historic concession to multiple wells.

Situation: Operator

How did the offshore operators get into the adverse situation they've been striving so hard to get out of? It's an involved story:

1. For generations, it was conceded that the Continental Shelf under the gulf covered vast reserves of oil and gas. Our domestic producers needed these reserves to assure their future production.

2. Oil was found off Louisiana in 1938 but no further drilling was done until after World War II. After this, there was spasmodic drilling which could get up little momentum because of the wrangle between federal and state governments on who owned the offshore areas.

3. Following passage of the Submerged Lands Act in 1953, drilling began at a frantic pace. A boom fever took hold of the oil companies and each prediction for the offshore outlook was more glowing and romantic than the one just before. Big year was 1956; and 1957 started off at a lively clip. In February 1957, offshore drilling hit its peak in the Gulf of Mexico as 107 rigs churned the water off Louisiana.

4. All this time, the operators had paid more for their leases than they should, and perhaps more than they intended to. Their exploration, development, and production costs were higher than expected.

5. The offshore bubble burst in 1957 as world-wide crude surpluses forced a cut in allowables, offshore as well as on. Allowables have continued to slide since that time and the gloom has been heightened by a deterioration of crude prices. As a result, new drilling slowed to a crawl.

6. The operators and contractors still are party to a controversy between the state and federal governments on ownership of the outer Continental Shelf. This controversy has bred an allowable question. There is a line in the gulf beyond which the states don't claim ownership; yet, the states still control the allowables in the area.

While they have attempted to deal fairly with offshore operators, it would be an unnatural tendency for the states to increase allowables on federal leases especially if the increase would be at the expense of production in which the states have a tax interest. Unfortunately, these far-out areas are where allowable increases are most needed.

7. Even as they trimmed costs, the producers have strained to increase their marine oil production. They are succeeding; today, 25% of Louisiana's total oil production comes from its offshore areas. As a result, total income from offshore oil and gas is now equal, or nearly so, the daily operating expense.

Situation: Contractor

Many of the drilling contractors who went offshore have been hurt worse than the oil producers. Reason is that the contractors are smaller and the offshore business is a greater portion of their total revenue. Here is the drilling contractors' story:

1. Drilling contractors caught the offshore fever early from the enthusiasm of their producer customers. Many went heavily into debt to finance rigs; others formed offshore drilling companies on speculation, selling stock to anyone who'd buy. Soon, exotic marine-drilling equipment was coming down the ways at a furious rate. Everyone believed that if you could finance and operate an offshore rig, you automatically got contracts and good profits.

2. As long as activity was on the upswing, the contractors had work for their marine equipment and realized a good return on their investments. When 1957 brought its recession, two-thirds of the offshore rigs were suddenly out of work. Some 75% of the LST-type tender rigs owned by the operator-producers were permanently stacked. Many of the contractor-owned tenders were stacked, some permanently. The mobile drilling platforms were docked along the bayous of South Louisiana for lack of work. Some drilling firms went out of business.

3. In addition, there was a disastrous series of accidents in which mobile platforms overturned and were lost. Obviously, many of the existing platforms and barges were unstable and dangerous to operate under some conditions; they needed expensive modification.

4. The 30 to 40 rigs which did drill during 1958 quite often were operating at a loss. It was cheaper for the contractor to operate at a $1,000 loss than it was to let the equipment sit idle at a $1,500 to $2,000 per day loss to overhead and depreciation. New-equipment construction came to a standstill.

5. By early 1959, the pressure began to ease on offshore contractors. A number of the mobile platforms found work in waters off the shore from other countries; these units no longer vied for contracts in the Gulf of Mexico. In addition, the producing companies began to recover from their initial shock and stepped up the new-well drilling pace. From a low of 35 rigs in the gulf, the number rose to 55.

6. Contractors helped themselves by learning to operate more cheaply. In addition they began taking footage contracts which gave them the opportunity to make a profit by drilling faster.

7. As 1959 came to its close, all the available mobile tenders were back at work and several stacked tenders had been reactivated. As the demand for rigs continued brisk into 1960, some contractors succeeded for the first time in getting increased rates for their equipment. Most contractors are currently operating at a profit, but not enough profit to tempt any to build new barges.

Problems Continue

In spite of the problems the offshore producers have solved, there are some which remain and don't seem any nearer solution than ever.

Number one problem is the long time lag between investment and income. It isn't uncommon for a producer to spend more than $20,000,000 in leasing, proving, and developing an offshore field. And, often, 4 years have lapsed before he begins to realize his first income from the property. The interest on his investment is a real obstacle to the field's showing a profit.

Another nagging problem is finding enough oil or gas to make the investment worth while. The issue isn't strictly one of drilling enough dry holes to finally make a discovery. Some producers say they'd rather drill a dry hole than to find a small field. The small fields can't pay out at the high cost of offshore operations. And there's no way to determine the size of the field until it's been drilled.

Obviously, the operators are not going to abandon the offshore areas. None could believe they would after the February lease sale. At that federal sale alone, producing companies paid more than $284,000,000 for deepwater leases; this was more than three times the most optimistic estimate of the total.

OFFSHORE ACTIVITY

Most are confident the offshore gamble will pay off, even if that payoff is farther in the future than originally thought. In fact, before they have overcome all the problems of drilling in water less than 100 ft. deep, the oil companies are looking at 200 and 300-ft. depths and even glancing at the 600-ft. mark.

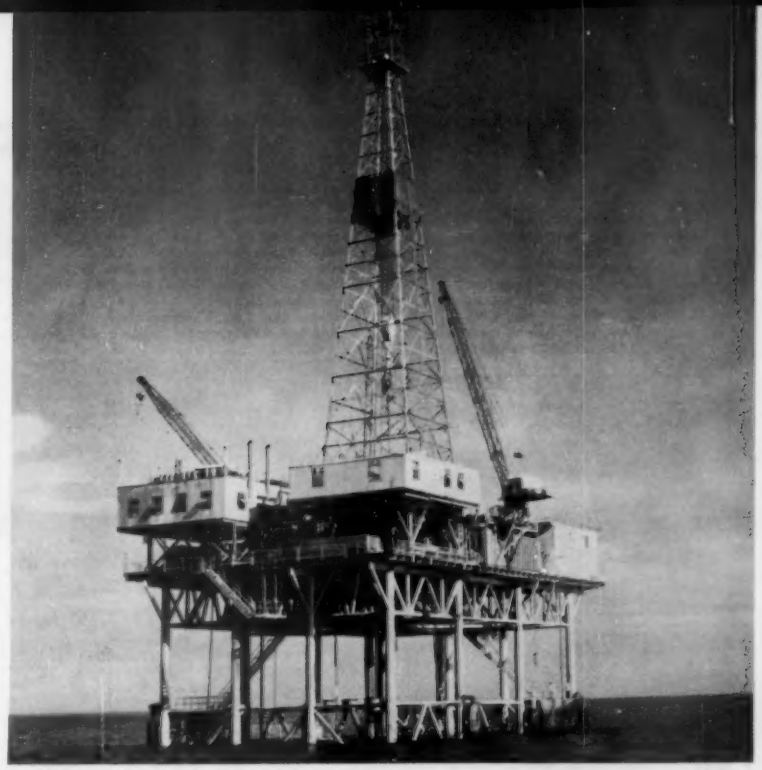
Tied together. The relation between operator and contractor in offshore work is much closer and more involved than the similar relation on land. Not only because the stakes are higher, but because their operations are so interwoven that delays, mistakes, and methods of operating of one vitally affect the other financially.

For instance, insurance cost and problems for land operators and contractors are not necessarily related; what one does has no particular effect on the other. But, what a difference offshore! Insurance costs are a major item in the budgets of both and the experience of one directly affects the other.

Thus, while the offshore contractors assume most of the blame for their problems, they still contend that part of their trouble is the fault of the operators. These contractors cite the low rate charged for drilling equipment. These contractors had no choice but to reduce rates or have the rigs idle. This reduction was made first at the expense of profit and then at the cost of extending depreciation and amortization schedules. You can't expect the operators to do other than take the lowest bid if the contractor can get the job done.

Even so, this short-run gain may be costly in the future, particularly on wells below the 100-ft. water depth. The contractors in business today will be most hesitant about risking their own money again when operators begin to need new, bigger, and better equipment for deepwater drilling. Result could be that the producers will have to furnish their own drilling equipment. Certainly those producers who built units for the first stages of offshore development prefer not to become involved in owning and operating any more offshore units.

Rapid obsolescence. The most frightening specter facing the offshore drilling contractor is obsolescence of his equipment. Most are amortizing their investments on an 8-year basis because prices cannot support any faster writeoff. Thus these firms must recognize the possibility that fast-changing offshore drilling methods may completely outmode their equipment before the purchase cost is recovered.



OFFSHORE MOBILE UNIT features compact, unitized design. Entire rig can be handled in six lifts by the derrick barge.

Many of the early mobile drilling units had to be sent back to the shipyard for modification long before they had returned their initial cost. Repair is a constant expense.

Typical is one contractor's workhorse platform which drilled more than 50 locations off Louisiana and Texas. Despite one major modification and two major repair jobs, the platform was obsolete after only 4 years and had to be dismantled and salvaged. The contractor-owner did little more than recover his investment.

Few doubt that the producers will be calling for new drilling equipment soon. Sizable chunks of the acreage sold in February were in waters deeper than 200 ft.; some is covered by more than 300 ft. of water. Present water-depth record for an offshore well is just over 200 ft.; this well was drilled from a small tender-type platform. No mobile equipment yet used in the Gulf of Mexico can drill waters deeper than 150 ft.

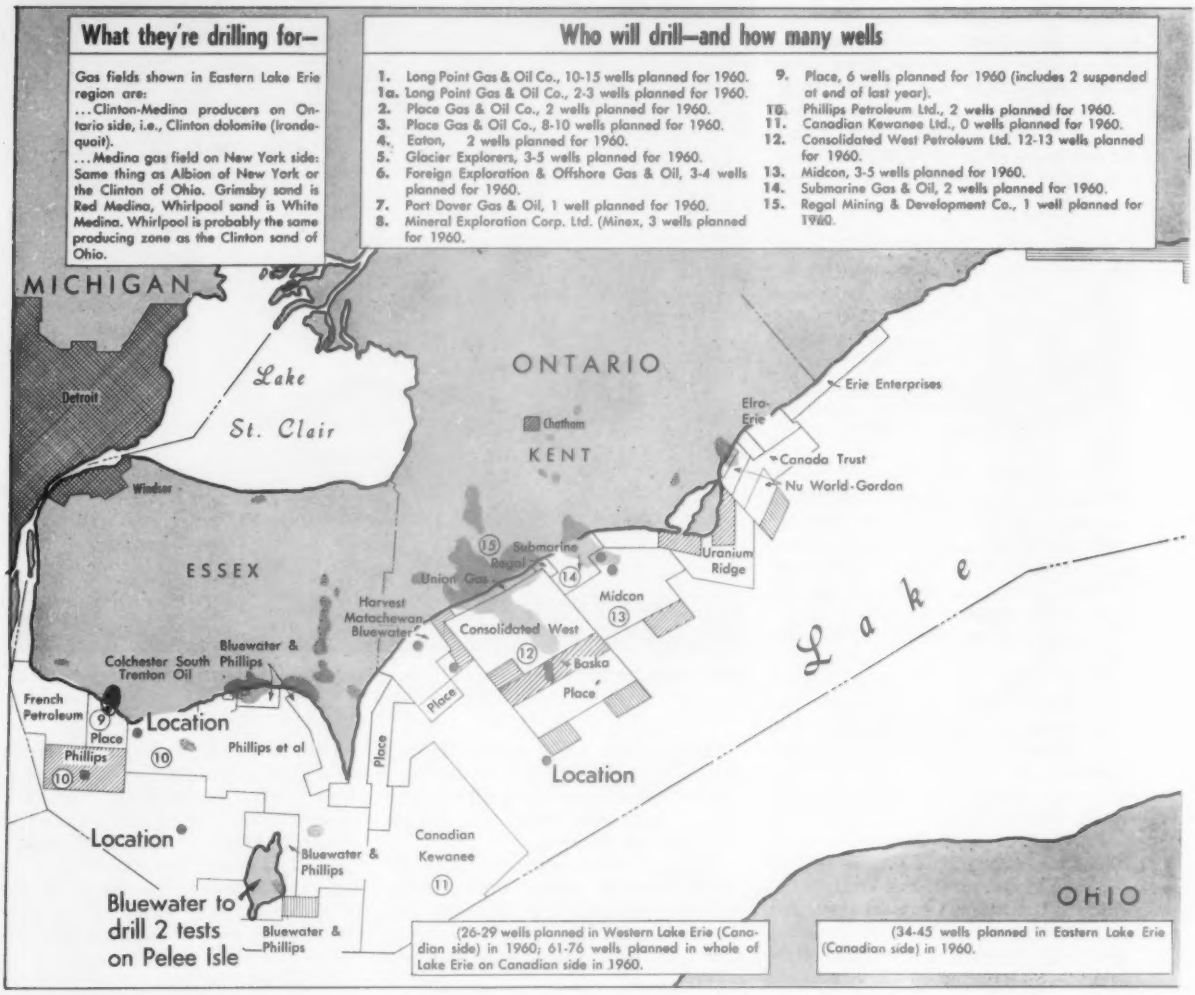
There's much talk of drilling from floating ships and making ocean-bottom completions. The floating-rig idea has not been tried in the gulf but Shell Oil Co. has made an experimental underwater completion; the operation was conducted in great secrecy from a conventional drilling unit and Shell has announced none of its conclusions from the test.

Next: underwater storage. Offshore producers all believe they must develop some system of storing crude oil underwater in their offshore fields. Abovewater storage is too expensive in most cases. The operators prefer to produce into a pipeline but smaller fields and new fields often have no line to shore; they must store the produced crude in tanks on the platforms or in barges tied up to the platforms.

While no one has yet operated an underwater storage unit, several are in the offing. Ocean Drilling & Exploration Co. (ODECO) has announced it is constructing an underwater-storage facility for 30-ft. of water. Another company has let contract for a different design. Both these units store the produced crude in submerged steel cylinders which form an integral part of the structure.

A third group of companies is presently installing and testing a rubber-tank system off Louisiana. Because these tanks are flexible and collapsible, the oil in them is not displaced out with water. Rather, the pressure of water above the tank flattens it out as the oil is withdrawn. This system has been suggested for storage of oil products for the armed forces as well as for storage of crude in offshore fields.

Other offshore engineers are hopeful of being able to include storage room in the bases of their producing platforms. These men believe that the extra cost of steel in the platform would be much less than buying an entirely separate storage unit.


What they're drilling for—
Gas fields shown in Eastern Lake Erie region are:
...Clinton-Medina producers on Ontario side, i.e., Clinton dolomite (Irondequoit).
...Medina gas field on New York side: Same thing as Albion of New York or the Clinton of Ohio. Grimsby sand is Red Medina, Whirlpool sand is White Medina. Whirlpool is probably the same producing zone as the Clinton sand of Ohio.
Who will drill—and how many wells
1. Long Point Gas & Oil Co., 10-15 wells planned for 1960.
1a. Long Point Gas & Oil Co., 2-3 wells planned for 1960.
2. Place Gas & Oil Co., 2 wells planned for 1960.
3. Place Gas & Oil Co., 8-10 wells planned for 1960.
4. Eaton, 2 wells planned for 1960.
5. Glacier Explorers, 3-5 wells planned for 1960.
6. Foreign Exploration & Offshore Gas & Oil, 3-4 wells planned for 1960.
7. Port Dover Gas & Oil, 1 well planned for 1960.
8. Mineral Exploration Corp. Ltd. (Minex, 3 wells planned for 1960.
9. Place, 6 wells planned for 1960 (includes 2 suspended at end of last year).
10. Phillips Petroleum Ltd., 2 wells planned for 1960.
11. Canadian Kewanee Ltd., 0 wells planned for 1960.
12. Consolidated West Petroleum Ltd. 12-13 wells planned for 1960.
13. Midcon, 3-5 wells planned for 1960.
14. Submarine Gas & Oil, 2 wells planned for 1960.
15. Regal Mining & Development Co., 1 well planned for 1960.
MICHIGAN
Detroit
Lake St. Clair
Windsor
ESSEX
ONTARIO
Chatham
KENT
Erie Enterprises
Elro-Erie
Canada Trust
Nu World-Gordon
Uranium Ridge
Submarine Regal
Union Gas
Midcon
Harvest Matachewan Bluewater
Consolidated West
Baska
Place
Bluewater & Phillips
Colchester South Trenton Oil
French Petroleum
Location
Phillips et al
Phillips
Canadian Kewanee
Bluewater to drill 2 tests on Pelee Isle
OHIO
(26-29 wells planned in Western Lake Erie (Canadian side) in 1960; 61-76 wells planned in whole of Lake Erie on Canadian side in 1960.
(34-45 wells planned in Eastern Lake Erie (Canadian side) in 1960.

Great Lakes search focuses on

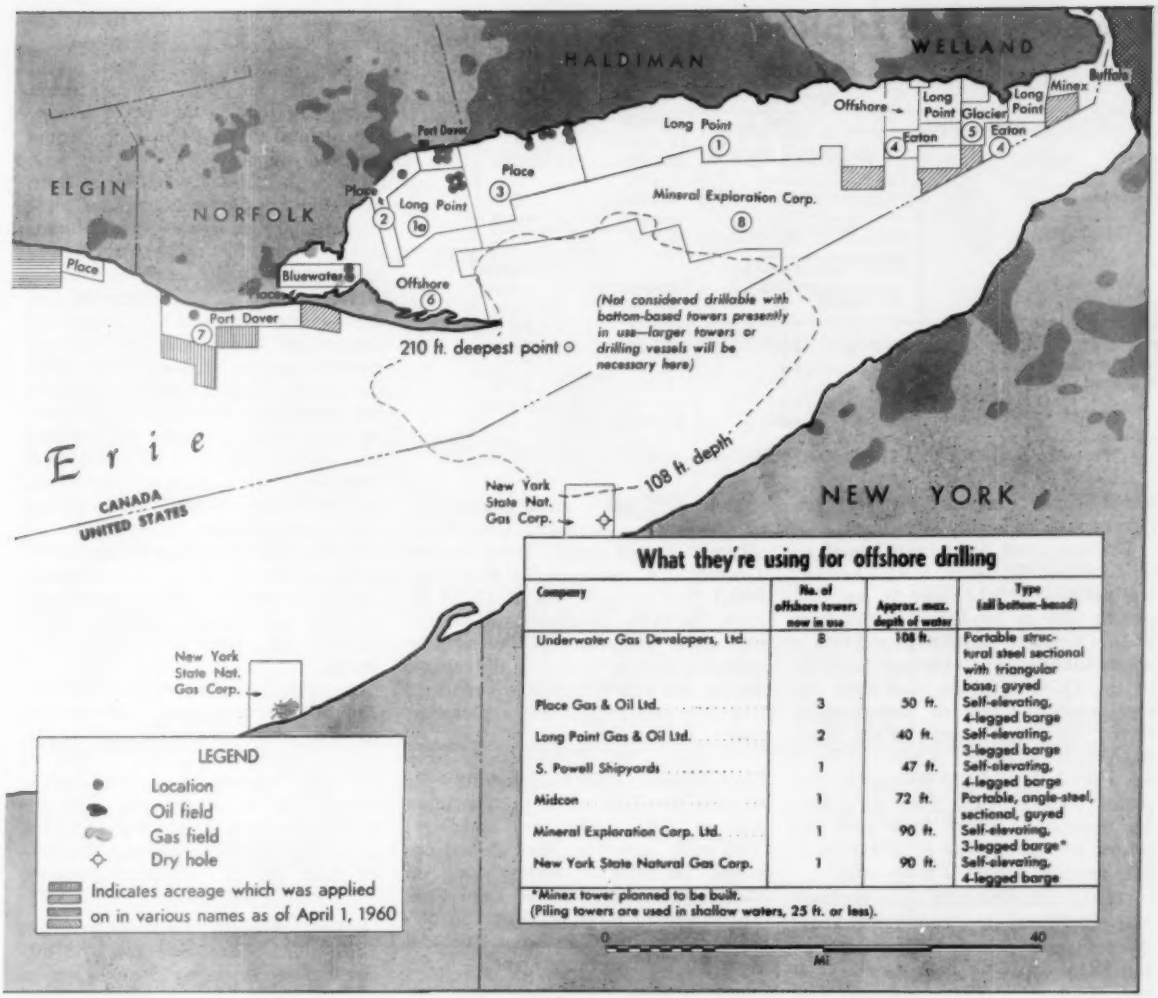
THIS WILL BE the busiest drilling season yet on Lake Erie. Some 28 companies were busy last year in drilling under Lake Ontario waters, drilling more than 101,000 ft. of hole and spending more than $3,000,000. Proved reserves increased 13 billion cubic feet with a cash value of about 4.5 million dollars. Probably gas reserves are two to three times greater. Daily potential flow of gas last year from new wells on Lake Erie was 28.7 million cubic feet.

BY BRYSON C. DONNAN
Consulting Geologist, Clarkson, Ont.

Drilling. Last year's drilling activity on Lake Erie was 35% higher than in 1958. There were 48 field wells completed and 25 wildcats went by the board. All were drilled for gas. With spring arriving on the lake, 1960 activity should be considerably higher than in 1959. Some estimates state a 15% increase is in store for lake explorers this year. Most of this activity will be off Norfolk, Haldimand, and Welland counties, Ontario, at the east side of Lake Erie. Objective will be gas in the shallow 700-1,100-ft. Clinton Medina sands.

Five new gas fields and one new oil pool in lake waters in recent months give a hint of larger fields to come . . . fields like Tilbury and Declute with their lakeside extensions. Tilbury gas pool, an offshore producer, was the pioneer in Lake Erie gas exploration. There are 70 producers out of 74 tries—a 95% success ratio. The offshore drilling at Declute boasts a 74% success ratio. Both of these fields produce in the Salina A-2 and Guelph formations at 1,300 to 1,700 ft.

Gas exploration will be heavy on the east end of the lake this year. From Long Point Bay, Norfolk County, to Point Albino, Welland County, there have been four gas fields developed and one lone gas producer, for a success ratio of 56%. Three wells drilled near Port Maitland have a com-



What they're using for offshore drilling

Company	No. of offshore towers now in use	Approx. max. depth of water	Type (all bottom-based)
Underwater Gas Developers, Ltd.	8	108 ft.	Portable structural steel sectional with triangular base; guyed
Place Gas & Oil Ltd.	3	50 ft.	Self-elevating, 4-legged barge
Long Point Gas & Oil Ltd.	2	40 ft.	Self-elevating, 3-legged barge
S. Powell Shipyards	1	47 ft.	Self-elevating, 4-legged barge
Midcon	1	72 ft.	Portable, angle-steel, sectional, guyed
Mineral Exploration Corp. Ltd.	1	90 ft.	Self-elevating, 3-legged barge*
New York State Natural Gas Corp.	1	90 ft.	Self-elevating, 4-legged barge

*Minex tower planned to be built.
(Piling towers are used in shallow waters, 25 ft. or less).

eastern end of Lake Erie

bined open flow of more than 11,000 M.c.f.d.

Some 30 companies hold 1,398,278 acres on Lake Erie. Six of these companies have more than 100,000 acres. This plus last year's tremendous success promises 1960 to be a boom year on Lake Erie for gas exploration with 70 wells planned.

Activity in 1959 centered on the western and eastern Lake Erie regions. In the west end, 43 offshore wells were drilled, resulting in 16 gas producers, 1 oil well, and 26 dry holes. Drilling is tougher and more expensive here, and the companies' holdings in the west end are being consolidated and pared down on the basis of the drilling results to date. Approximately 26 to 29 wells are planned in western Lake Erie in 1960.

Consolidated West Petroleum Ltd.'s investment of $2.5 million, which has reportedly been put in the ground in Tilbury gas field under lake extension, has resulted in a gross annual take to that company of approximately $1 million per year, from gas sales. Gas is produced from the Salina-Guelph formations, is sour and brings 35 cents per M.c.f. Submarine Gas & Oil Ltd. has four wells on production in offshore DeClute gas field, plans on hooking up three more in 1960, and possibly drilling further there. Midcon is making plans to hook in to shore some five wells in this same area in 1960.

Focus shifts east. The trend is shifting to eastern Lake Erie in the search for offshore gas, with up to four pay zones present. During 1959, 32 wells were drilled resulting in 17 gas producers and 15 dry holes. An estimated 34 to 47 wells are planned here for the 1960 season. During 1959, new gas initial potential discovered by an estimated $3 million spent in drilling, totaled 28,801 M.c.f.d. (and a potential of 200 bbl. per day of oil). Of this total, 10,645 M.c.f.d. (and one oil well) were found in western Lake Erie while 18,156 M.c.f.d. was

1959 Lake Erie Exploratory Breakdown

ONTARIO

County—	Wildcats drilled	Footage	Success ratio
Essex	7	11,876	0
Kent	15	25,099	7%
Elgin	1	1,475	0
Norfolk	2	2,499	0
Total	25	40,949	....

	Field wells drilled	Footage	Success ratio
Essex	3	4,600	66%
Kent	17	24,138	76.5%
Norfolk	13	15,109	46.2%
Haldimand	13	12,174	77%
Welland	2	1,900	50%
Total	48	57,921	....

*From Eastern Gas and Oil Report, Port Credit, Ont.

found in the east end. These latter figures may be highly significant.

Drilling costs have been found to be considerably lower, a well averaging perhaps $13-$15 per ft. vs. $25 per ft. (dry or producer) in the west end. Of course, depth to production is about 1,050 ft. vs. an average 1,300 ft. to the Guelph in the west end. In fact, with the use of self-elevating three and four-legged barges costs have reportedly been as low as $7,000 for a dry hole and $13,000 for a completed well; pipeline costs to collection points on shore have been reported to approximate $7,000 to $10,000 per well (about 2 miles out).

The Clinton-Medina gas is sweet and considered dry, commands about 38 cents per M.c.f. and on an intermittent basis as high as 45 cents per M.c.f.

Reserves in the east end in the Whirlpool sandstone alone compare favorably with reserves in the Guelph reefs of the west end. Operators in the east end are hoping for a possible opening up of the Medina sands as drilling activity moves away from the Ontario shore, downdip to the south, to result in even greater reserves in multiple zones.

Of interest is the fact that Mineral Exploration Corp., Ltd., (Minex), having been temporarily balked in its drilling plans for Lake Huron, has transferred its efforts to the eastern Lake Erie region. As the main newcomer there, the company plans on drilling three wells on a rather large-acreage block there.

Bluewater Oil & Gas Co., Ltd., deserves mention for the noble effort of drilling so many tests offshore with unfortunate results. This operator, together with Marine Oil & Gas Co., will drill two tests on Pelee Isle and chances for encountering good production are geologically favorable. One will be a Trenton test.

Lake Erie holds great promise as an excellent gas province. One of the adjacent land areas, Humberstone Township in eastern Lake Erie, had initial flow rates of 3.5 to 12 M.M. c.f.d. There is no reason to believe that these rates cannot be met or exceeded in other sectors of the region. Surely, the nearby ready gas markets will help accelerate the exploration pace.

To date, 244 offshore wells have been drilled in Lake Erie and 10 wells in Lake St. Clair, all on the Canadian side of the international boundary. Two wells have also been drilled opposite the State of Pennsylvania on the United States side of Lake Erie. This makes a grand total of 256 offshore wells drilled in Lake Erie and Lake St. Clair to the present.

Suspension order. On November 26, 1959, the Ontario Provincial Government temporarily suspended offshore drilling in Lake Huron, Lake St. Clair, the St. Clair River, and the Detroit River. Imposed at a time when actual drilling activity was to commence in Lake Huron, the suspension was to apply pending a study by an impartial committee on possible pollution by drilling activity in the Great Lakes fresh-water system. It was unfortunate that the industry was singled out in this connection and that the matter became a political issue.

However, no one has any quarrel with gas drilling offshore, and it is the opinion of some that with recommendations on more strict controls on drilling and equipment and techniques, which would be designed to minimize any possibility of oil pollution, drilling will ultimately be permitted in these waters to unlock the important oil and gas reserves which undoubtedly exist there.

This marks the second time offshore drilling in the Great Lakes has suffered from the objections of others. On the first occasion the fishing industry felt that the noise of drilling activity was driving away their catch, and serious attempts were then made to halt lake drilling. Now, of course, it is realized that lower fishing income has been the result of a combination of several factors, with no relation to offshore-drilling activity. The most logical factor is that fish life abounds in cycles and that the present period represents a low point in that cycle; others, perhaps equally important, are: the adverse effects of the predatory lampre eel killing off fish life; the plentiful supply of lower-value catch (i.e. perch vs. more valuable pickerel), the tremendous number of smelt may be using up the available food supply; the adverse effects of industrial and municipal pollution from communities bordering on the Great Lakes, and from pollution by shipping.

These factors are causing grave concern among all of the surrounding governments, and render insignificant any possible pollution from oil and gas exploratory drilling offshore.

No pollution has resulted from the 256 offshore-well total, with one exception, where an unexpected oil discovery resulted in a few barrels of oil being released by accident on the water with no ill effects. The industry is certain that with proper controls and drilling technique this sort of thing can be virtually eliminated.

Wells planned. Place Gas & Oil Ltd., which discovered the first offshore oil wells in the Great Lakes, in the Trenton formation, plans on completing the two wells which were suspended in 1959, and on drilling four additional wells in Lake Erie, at Colchester, in 1960. The company is pioneering in offshore oil production in the Great Lakes, plans on drilling to the Trenton with cable tools, casing the hole, and completing the wells with rotary equipment (power swivel). The company also plans on producing the wells remotely from shore. Dual lines are to be run to each well, oil from the one activating a bottom-hole hydraulic pump in the well through tubing, the other being a return line to oil storage onshore. Continuous or intermittent injection of solvents will be used to offset waxing problems.

On the land development side of the Colchester field, a National 20 rotary rig has been completing 2,100-ft. wells in 2 weeks vs. the 6 weeks for the Bucyrus Erie 36-L cable-tool rigs commonly used, with costs now becoming comparable. The Imperial-Harvest-Submarine team is currently averaging 650 bbl. daily from nine producing wells.

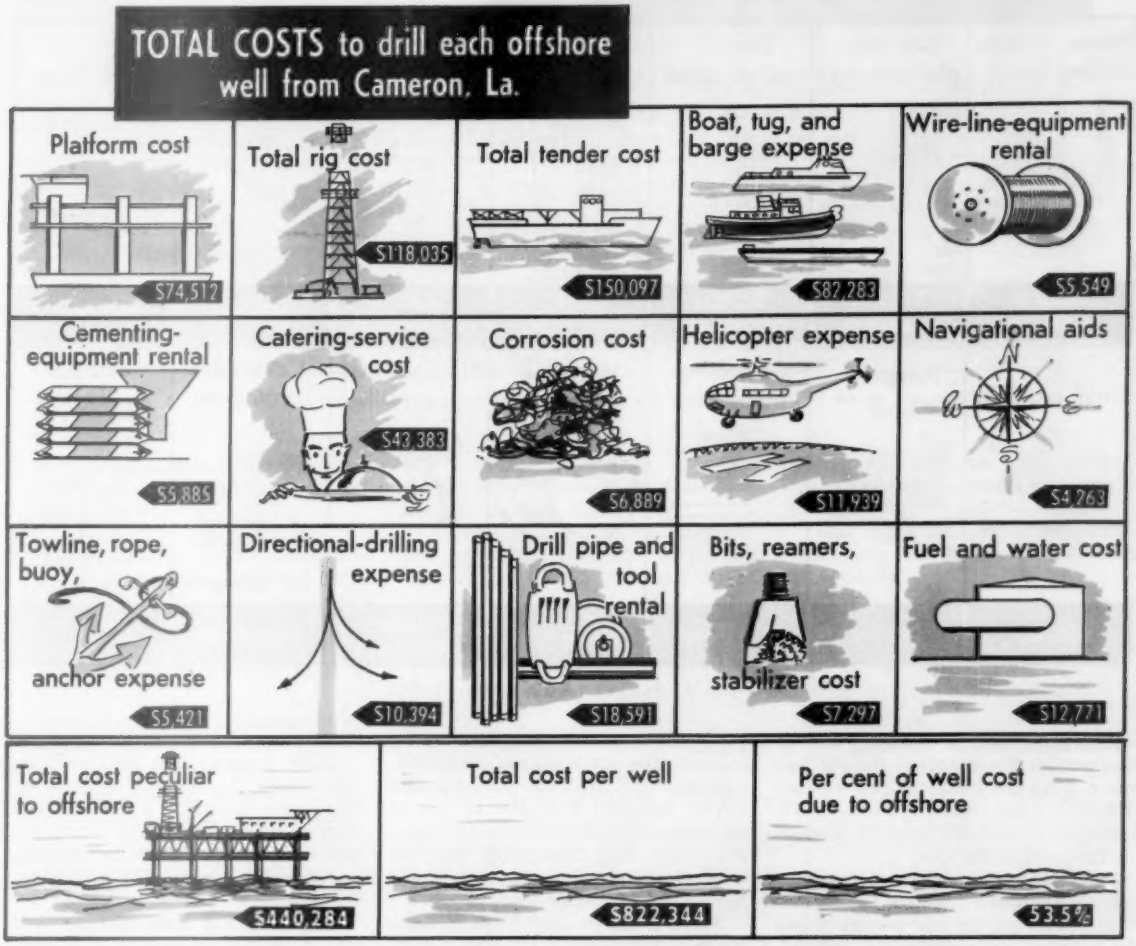


Table 1. These figures are the average for 26 wells drilled from tender-type platforms in 50 to 60 ft. of water. An average of five wells was drilled on each platform to an average of 11,000 ft. Source: CATC exhibits to FPC.

Offshore figures tell costly story

HOW MUCH does it cost to drill an offshore well?

"Too much quite often at today's allowables and today's price for oil and gas!" Thus say many harried offshore operators. It isn't hard to back up this statement if you examine the actual prices these operators pay for their wells. A good example of these prices is contained in testimony CATC has given the Federal Power Commission.

CATC is the name given the offshore combine that includes Continental Oil Co. (operator of CATC), Atlantic Refining Co., Tidewater Oil Co., and Cities Service Oil Co. CATC introduced its cost testimony into a case which is to determine the price these companies get for gas produced from leases offshore from Cameron Parish, Louisiana.

BY ED McGHEE
Drilling Editor

CATC shows that it pays 2 to 5 times more for its wells offshore than for similar wells onshore. Moreover, these wells are 3 to 5 times as costly to produce as dry-land wells.

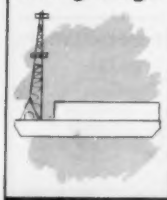
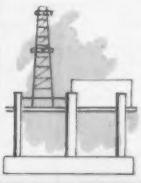
The CATC figures, some of which are reproduced on these pages, are exclusive to that group's operations in the East and West Cameron areas; these costs cannot be correlated directly with any other company's costs in some other area where conditions are different. But, the CATC costs are an excellent guide to show the newcomer to offshore work what he must be prepared to pay to complete a well in the Gulf of Mexico.

$800,000 per well. Table 1 shows the individual items that made up the cost of 26 CATC wells drilled from tender-type platforms in 50 to 60 ft. of water. Average total cost was $822,344 per well; more than 50% of that cost resulted from the fact the wells were offshore.

Actually, this $822,344 figure doesn't tell all the story. For instance, that figure includes only a portion of the cost of the platform; expense for installing the platform was spread over the several wells drilled from each. Such a tender-type platform in 50 ft. of water costs $375,000 to install, according to H. H. Rushing, senior production engineer for Continental who presented the CATC testimony.

Moreover, the tender which serves the platform cost $1,500,000; the ten-

TIME-DEPENDENT COSTS OFFSHORE

Rental, mobile drilling barge	Day rate, platform rigs	Derrick-barge rental	Catering service	Helicopter rental	Work-boat rental	Crew boat
						
$4,500 to $8,500/day	$1,200 to $1,800/day	$7,500 to $10,000/day	$500/day	$3,500 to $6,500/month	$575/day	$225/day

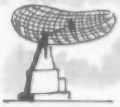
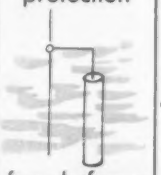
Small tug boat	Pumpers' boat	Cementing-equipment rental	Wire-line equipment	Navigational aids	Corrosion protection	Corrosion protection
					for tenders	 for platforms
$100/day	$90/day	$2,450/month	$2,000/month	$360 to $600/month	$42,000/year	$4,000 to $9,000/year

Table 2. Source: CATC exhibits to FPC.

der alone carries $700,000 worth of equipment. To transport the rig and place it on the platform cost another $60,000. Thus, Rushing says, CATC had spent $2,635,000 before it spudded its first well in the area.

Had the company used self-contained platforms instead of tender-type platforms, the cost picture would be different, but probably not reduced. The self-contained platform cost $900,000 to build and set up. Living quarters, pipe racks and the like would have cost another $400,000 to purchase and place on the platform.

Suppose CATC had used a mobile drilling barge which requires no platform; buying one would have cost $2,500,000 to $6,500,000. Renting such a mobile rig would have been $4,500 to $8,500 per day.

Time is quite costly. As Table 1 shows, CATC spent much money renting boats, helicopters, wire-line equipment, and the like. Table 2 shows how much this essential equipment costs on a daily or monthly basis. It's apparent that a little lost time such as might be entailed by heavy seas causes more than a little expense.

Some of these time costs are misleading because they don't show initial investment. For instance, CATC figures it paid $42,000 per year to fight corrosion on its tenders. Rushing estimates that it cost $50,000 originally to put corrosion-protection material on the tenders; such material cost $25,000 for a tender-type platform and $50,000 for a self-contained platform.

Even after the wells are completed, corrosion still goes on. Rushing said CATC has paid $179,400 to protect its producing wells alone in the Cameron area. Had these wells been on land, Rushing said, the cost would have been $5,000 or less.

Table 2 shows only $300 to $600 per month per well as the cost of navigational aids. Actually, the lights, fog horn, and engine included in this category cost about $17,500 per platform.

Directional wells extra. We mentioned that the platform expense assigned to each well is lower because several wells are drilled from each platform. This means that all wells except one must be directionally drilled. So, while the second, third, and later wells don't require a new platform, they do introduce a new expense. Not only do directional wells call for special tools, they also take more time to drill and to complete.

Table 3 shows that for a comparable depth (11,500 ft.), it took 6.2 more days to drill a directional well than a straight one. The directional well took 6.9 days more to complete, and it lost 3.2 more days in fishing.

Depths matter little. Deeper wells cost more than shallow ones, whether offshore or on. Besides this truism, there's no concrete correlation of drilling costs by depth brackets, such as shown in Tables 4 and 5. There seems to be no trend in the cost ratio (offshore to onshore) as wells deepen, whether producers or dry holes.

While the material in Tables 4 and 5 is from the CATC testimony, that in Table 6 is from a survey released last year by the American Petroleum Institute, the Mid-Continent Oil and Gas Association, and the Independent Producers Association of America. This joint survey covers greater areas than does the CATC information; the

Table 3. Average of 26 directional wells with average of 12 vertical wells in Cameron Parish. Average drilling depth of latter was slightly deeper than on the directional wells. Thus, number of drilling days was corrected so that both types are compared for 11,500 ft. Source: CATC exhibits to FPC.

EXTRA COST OF DIRECTIONAL DRILLING

	Directional wells	Vertical wells
Depth compared, ft.	11,500	11,500
Drilling days (corrected to 11,500 ft.)	50.8	44.6
Completion time, days	25.2	18.3
Fishing days	9.2	6.0

COST OF PRODUCING WELLS BY DEPTHS

Offshore Cameron, La. compared to South Louisiana

Depth interval	Location	Total cost per well	Ratio, offshore to on	Direct producing cost per year	Ratio, offshore to onshore
7,500 to 10,000 ft.	Offshore	$ 783,134	294%	$37,024	329%
	Onshore	266,159		11,248	
10,000 to 12,500 ft.	Offshore	950,620	416%	40,316	491%
	Onshore	228,344		8,203	
12,500 to 15,000 ft.	Offshore	1,053,115	242%	42,877	287%
	Onshore	436,061		14,953	

Table 4. Offshore wells drilled from tender-type platforms in 50 to 60 ft. of water. Source: CATC exhibits to FPC.

lower-cost California wells are those drilled from floating ships and not completed.

The unexpected. All the costs we've covered so far, the offshore driller should be able to expect and predict with some accuracy. Many costs arise from conditions he can't predict. The experience of CATC is evidence of this.

In drilling the 26 Cameron wells discussed, the group lost 122 rig-days—5.56% of the total rig time—because of weather. Some of this time loss was because of hurricanes; 1956's hurricane Flossie cost 9.4 rig-days; 1957's Audrey cost 60.4 rig-days. In addition, Audrey washed three CATC tenders aground.

Still, at least half of the time loss was during less-spectacular weather. Tender operations can't continue when waves are higher than 12 ft. If waves are higher, it is common to disconnect six of the seven anchors and allow the tender to ride on the bow or storm anchor, Rushing says.

Another example of the unpredictable expense is collision. Only a few months back CATC suffered $750,000 damage to a platform when an ocean-going freighter collided with a production platform.

And a spectacular blowout in another area cost the group in excess of $4,000,000.

DRY-HOLE COST

Offshore Cameron, La. compared to South Louisiana

Depth interval	Location	Total cost per well	Ratio, offshore to onshore
7,500 to 10,000 ft.	Offshore	$ 500,590	376%
	Onshore	133,250	
10,000 to 12,500 ft.	Offshore	842,699	396%
	Onshore	212,562	
12,500 to 15,000 ft.	Offshore	1,121,137	337%
	Onshore	333,144	

Table 5. Offshore wells drilled from tender-type platforms in 50 to 60 ft. of water. Source: CATC exhibits to FPC.

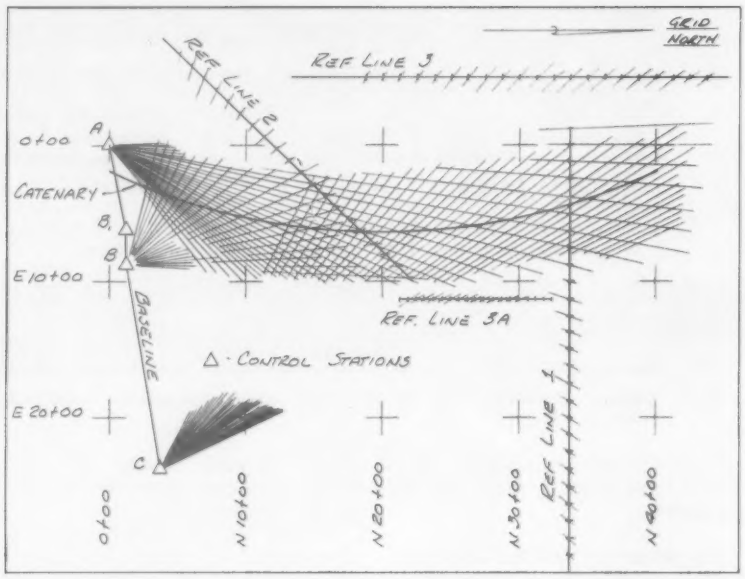
Table 6. These figures are from industry-wide census made in 1959 by the API, Mid-Continent Oil and Gas Association, and IPAA. They are for 1956 only, and are averages for many operators of many different types of wells, in as little as 6 ft. of water and less than 1 mile from shore to as much as 200 ft. of water 50 miles from shore.

COST OF DRILLING AND EQUIPPING WELLS

ALL OFFSHORE AREAS COMPARED TO ALL ONSHORE AREAS IN STATES OF LOUISIANA, TEXAS, AND CALIFORNIA

		LOUISIANA		TEXAS		CALIFORNIA	
Depth interval, ft.	Location	Total per well cost	Ratio offshore to onshore	Total per well cost	Ratio, offshore to on	Total per well cost	Ratio, offshore to on
5,000 to 7,500	Offshore	$216,767	322%	$ 293,429	476%	$290,571	271%
	Onshore	67,374		61,650		107,136	
7,500 to 10,000	Offshore	243,559	192%	269,368	242%	232,500	145%
	Onshore	126,667		111,085		159,835	
10,000 to 12,500	Offshore	484,602	210%	729,500	334%	360,000	163%
	Onshore	231,017		218,419		222,229	
12,500 to 15,000	Offshore	822,377	199%	1,114,800	398%	317,000	92%
	Onshore	413,971		279,815		343,410	

High-accuracy control systems for submarine pipelines



CONTROL SHEET shows methods for horizontal accuracy at river crossings. Fig. 1.

Control systems using the tellurometer for offshore operations and survey instruments for river crossings fulfill high accuracy requirements for locating submarine lines during installation.

BY R. J. BROWN

. . . chief civil engineer with Collins Construction Co., Port Lavaca, Tex. A 1950 graduate of Ohio University with a BS in civil engineering, Brown has had 10 years of experience in the pipeline industry, with 4 years in marsh and offshore operations. He was with Tennessee Gas Transmission Co. before joining Collins Construction. He is a member of the Texas Society of Professional Engineers, the American Congress of Surveying and Mapping, and the American Society of Civil Engineers.

A METHOD for accurately locating the pipe during installation of a submarine line is of inestimable value.

This is true whether it be for a line running far offshore, complicated by the hazards of rock outcrop and a narrow ditch to follow, or a river crossing to be laid on a specifically designed catenary. A ditch that has been dug or blasted through coral, rock, or shell reefs is useless unless positive horizontal control is available for placing the pipe in the ditch.

Many control systems can be used with varying degrees of accuracy. Those dealt with here are for higher accuracy requirements, using the tellurometer for offshore operations and survey instruments for river crossings.

Collins Construction Co. uses these systems, basing them on preprogramed instant-plotting sheets. This type of horizontal control lends itself well to Collins' procedure of pulling pipe by the friction - transposition method; that is, making pipe up on shore in specified lengths, then pulling it on the bottom in one continuous section.

River Crossings

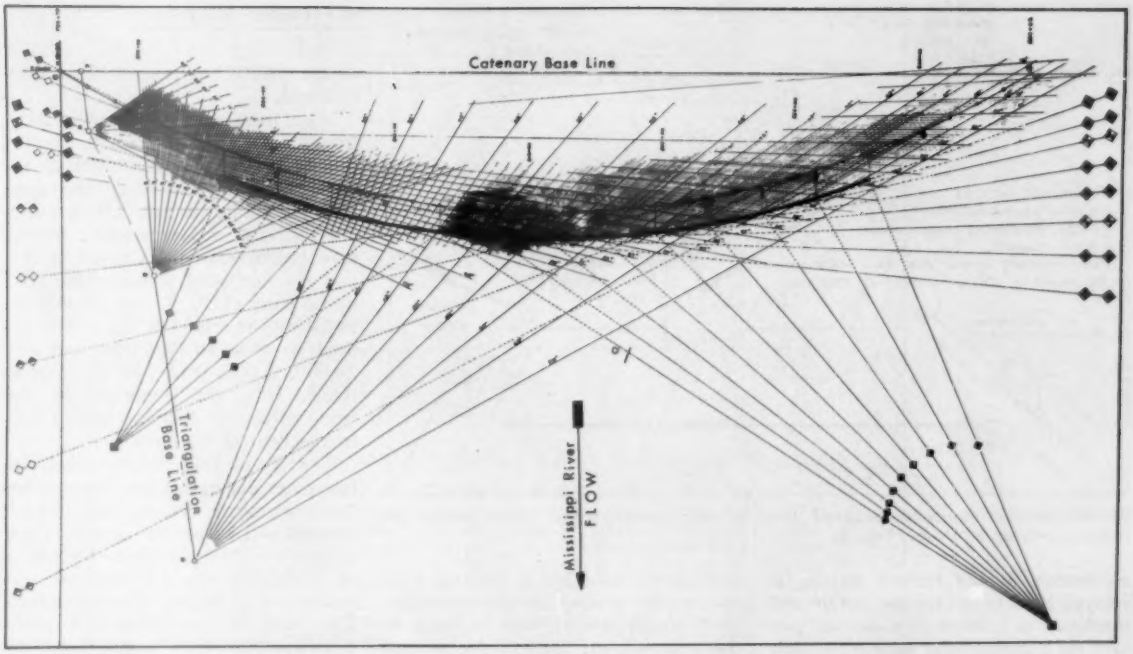
Major river crossings require a simplified horizontal - control system that is readily adaptable to either straight - across, up, or downstream catenaries. Since the distances are relatively short, the standard survey transit is much more applicable. The first step is to prepare an instant-plotting sheet by radiating lines from the various control points.

River crossings to 3,500 ft. in length can be worked up on 24 by 36-in. sheets at a scale of 1-in. equals 100 ft. For superior accuracy, plotting by coordinates is preferred to using drafting machines. The control sheet is constructed by establishing a coordinate system, then calculating and plotting coordinate points on a reference line for each of the radiated lines from control points on base line (Fig. 1).

Since a long base line would produce errors in the strength of the triangles on the base-line side of the river, a combination of base lines is used. Control points A and B are for coverage close to the base line, and points A and C for the opposite side of the river. For ease of calculation, reference lines 1, 2, and 3 are programed for control points A, B, and C, respectively. Although the process of preparing sheets this large is critical since a variation in temperature or humidity will result in substantial paper distortion error, distortion of the printed control sheets will not appreciably affect the scaling accuracy of the positioning (see Fig. 2).

In using a system of this type, two radio frequencies should be available to minimize confusion. On one construction job, the contractor's frequency was used for pulling operations and the owner's frequency for control. Two survey boats, equipped with fathometers, pick up the pipe, as the instruments on the base line lock on the boat and call respective angles to the control tower. These are immediately plotted on the prepared horizontal-control sheet.

Operating two survey boats, continuous fixes at the rate of one per minute are obtained throughout the pulling operation. Catenary target ranges are set initially for approximate visual positioning of the pipe-



DISTORTION of printed control sheets will not appreciably affect scaling accuracy of positioning. Fig. 2.

guide equipment. Employing the horizontal instant-plotting control, the true location of the pipe is known and corrections during the pulling operation are made to maintain the pipe on this design catenary.

Offshore

Although survey instruments will be accurate enough where distances are relatively short, situations involving placement of long lines under unusual circumstances demand a more exact system of horizontal control. For example, an owner specified a 3,500-ft.-long curve with a radius of 2,800 ft., 20 miles offshore in water 80 ft. deep (see Fig. 3).

Our method of installation dictates laying cable over the proposed route to anchor the pull barge on a tangent offset 2,000 ft. from the proposed platform. The pipe will then follow the cable as it is pulled 20 miles to an assigned location to be bent around a preset guide. Misplacement or distortion of this guide would overstress the pipe and concrete coating; therefore high-precision positioning will be established using two towers (in 40-ft. water) several miles from the proposed platform, as control stations for tellurometers.

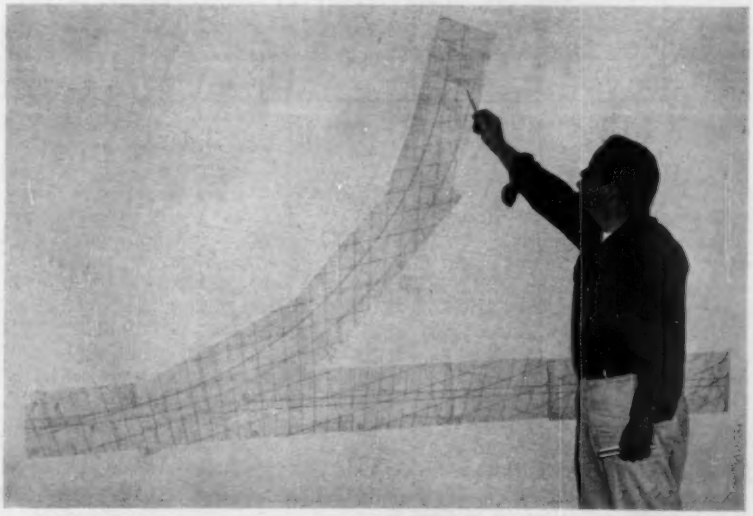
The Tellurometer

The tellurometer uses the microwave by measuring the elapsed time of the signal travel from the master to remote unit and return. A relatively recent development, the instrument has phenomenal accuracy that has introduced a new concept revolutionizing survey methods and procedures. The tellurometer consists of two major components, each being equipped with radio transmitters and receiver. These units, commonly called "master" and "remote" or "slave," come equipped respectively with tripod, power pack, and spare-part kit for most eventualities.

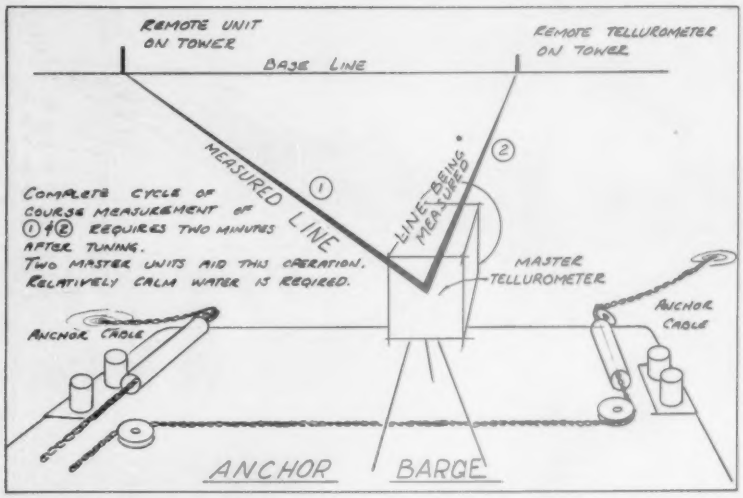
A barometer and psychrometer are also needed, since the tellurometer measurements depend on meteorological conditions. The minimum number of instruments for measuring is one master and one remote unit. Three men are generally employed to operate one master unit and one remote unit—two at the master, one of these recording the observations. For a control system of this type, two remote units are required with either one or two masters.

The tellurometer is a phase-comparison system similar to other phase-comparison systems used for distance and range measurement. It operates on the principle of the instantaneous sampling of the phase of independent oscillators at the master and remote stations.

The phase relationship of these



OFFSHORE LINE requires more exact system of horizontal control. Fig. 3.

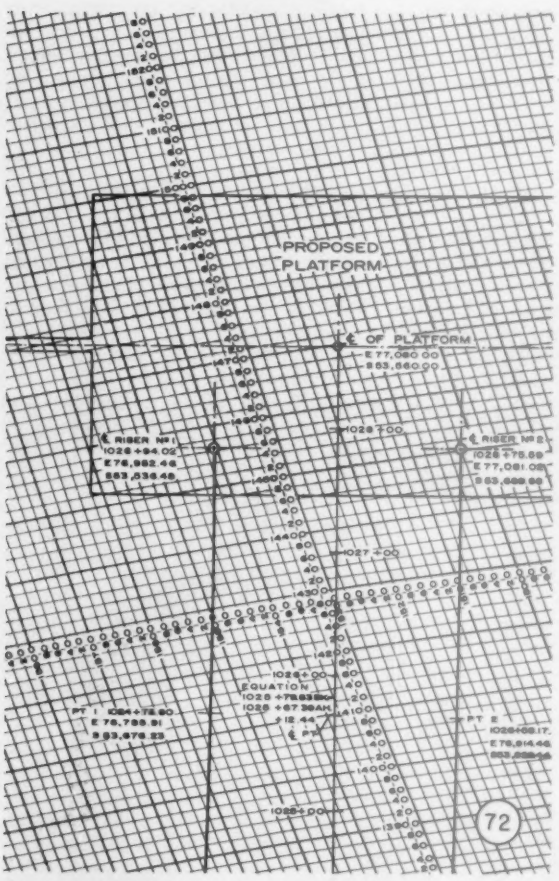


TELLUROMETER measures elapsed time of microwave signal from master to remote unit and return. Fig. 4.

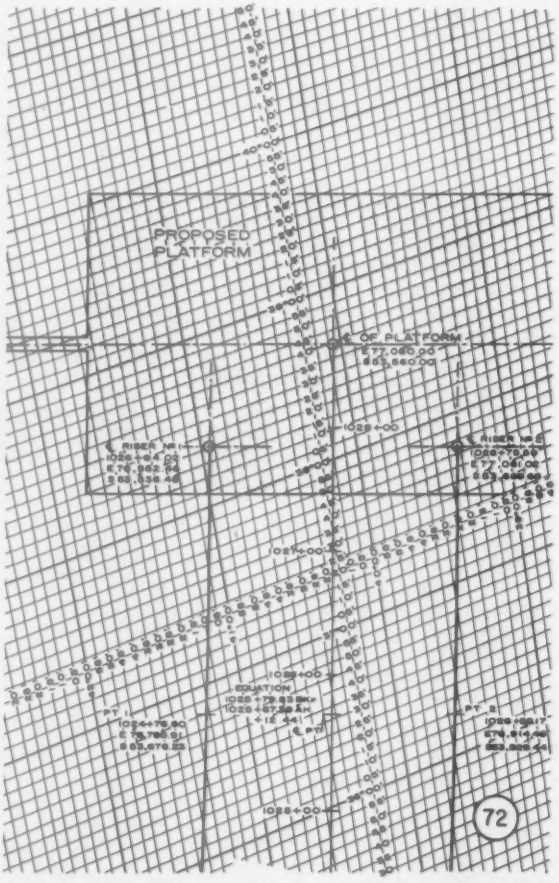
oscillators, at the remote station, is relayed back to the master station and displayed as a break in a circular pattern on a cathode-ray tube (the phase indicator) at the master station. The cathode-ray tube has a circular scale of 100 units around the circumference, from which readings can be made to the nearest even units or the nearest half unit by estimation. One division on the graticule represents about 6 in. in length.

If the master station is moved away from or towards the remote station, the break in the circular sweep on the cathode-ray tube revolves one complete revolution for every 50-ft. movement of the master station. Crystal modulation frequencies noted as A+ and A− are used to determine fractional parts of 50 ft. and crystals denoted by the letters B, C, and D are used to measure fractional parts of 50,000, 5,000, and 500 ft., respectively. Thus, the length of the line being measured must be known only to the nearest 10 miles.

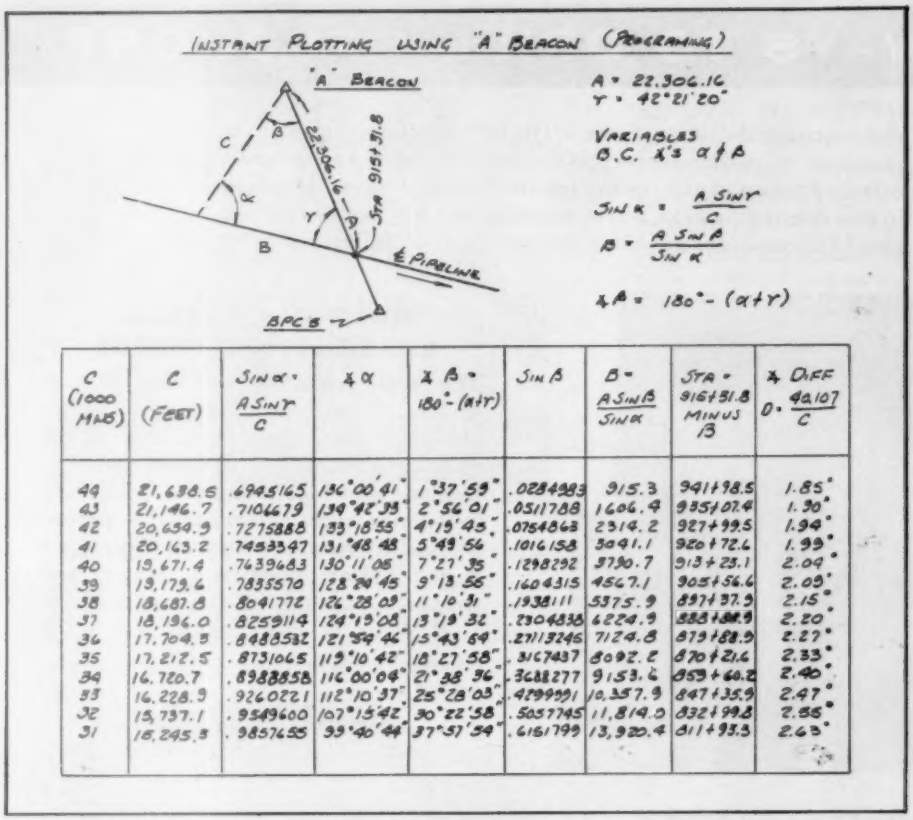
The coarse (one measurement) tellurometer distance, using a correction for temperature, density, and air water content will be precise enough. Operating on stable platforms, accuracies of 1:300,000 can be obtained with successive averaged (fine) readings. The unit of measurement is millimicrosecond (MUS), which is approximately 0.49 ft. in length. One milli-



TELLUROMETER horizontal instant-plotting control indicates the even 20 millimicrosecond lines from two control stations. Fig. 5.



SURVEY INSTRUMENT horizontal instant-plotting control indicates radiated lines from control points in 0° and 5-minute intervals. Fig. 6.



C (1000 MUS)	C (FEET)	SIN α = A SIN γ / C	∠α	∠B = 180° - (α+γ)	SIN B	B = A SIN B / SIN α	STA = 916+31.8 MINUS B	∠ DIFF D = 4°21'07 / C
44	21,638.5	.6945165	136°00'41"	1°37'59"	.0284983	915.3	941+98.5	1.85°
43	21,146.7	.7104679	139°42'33"	2°56'01"	.0511788	1606.4	935+07.4	1.30°
42	20,654.9	.7275888	133°18'55"	4°19'45"	.0754863	2314.2	927+99.5	1.94°
41	20,163.2	.7453347	131°48'48"	5°49'54"	.1016158	3041.1	920+72.6	1.99°
40	19,671.4	.7639683	130°11'08"	7°27'35"	.1298292	3790.7	913+23.1	2.09°
39	19,179.6	.7835570	128°24'45"	9°13'56"	.1604315	4567.1	905+56.6	2.09°
38	18,687.8	.8041772	126°28'09"	11°10'31"	.1938111	5375.9	897+37.5	2.15°
37	18,196.0	.8259114	124°19'08"	13°19'32"	.2304838	6224.9	888+88.9	2.20°
36	17,704.3	.8488532	121°54'46"	15°43'59"	.2711326	7124.8	879+88.9	2.27°
35	17,212.5	.8731065	119°10'42"	18°27'58"	.3167437	8092.2	870+21.6	2.33°
34	16,720.7	.8988858	116°00'04"	21°38'36"	.3688277	9153.6	859+60.2	2.40°
33	16,228.9	.9260221	112°10'37"	25°28'03"	.4299991	10,357.9	847+35.9	2.47°
32	15,737.1	.9549600	107°15'42"	30°22'58"	.5057745	11,814.0	832+99.8	2.56°
31	15,245.3	.9857655	99°40'44"	37°57'54"	.6161799	13,920.4	811+93.3	2.63°

USING tellurometer, the relation between center line and control station can be calculated and plotted. Fig. 7.

microsecond is 10^{-6}, or one-billionth of a second.

In other words, a microwave traveling at the speed of light (186,000 miles per second) in 1 MUS travels 0.49 ft. and returns. It has been reported that a maximum distance of 96 miles has been measured, requiring an instrument height of 1,900 ft. for each unit. Only under unusual conditions can observations of this type be made.

The master unit, or masters, occupy an anchor or spud barge and distances are measured to the slave units on shore (see Fig. 4). With a known base line between the slave-unit control points, a fix can be obtained quickly by noting the position on horizontal - control instant - plotting sheets.

Instant-Plotting Sheets

In its initial stages, a control system of this type requires first-order triangulation which, if not available, can readily be established with the tellurometer. Once the pipeline, or installation, is tied into this network, the relation between center line and control station can be calculated and plotted. It is a matter of programing (see Fig. 7) by calculating the angle and station where the 20 MUS arcs cross the center line. The even 1,000 MUS lines are calculated and the distances between subdivided into 100, then again into 20-MUS spacings.

Rolls of drafting paper are cut in 9-in. widths and continuous center-line stations are established at a 1-in. = 50-ft. scale. By lining up several drafting tables, one roll can be worked on by a number of people on an assembly-line basis. The first table plots center line and numbers stations; the second table plots MUS line from one control; the third table plots MUS lines from a second station. The fourth table letters the MUS lines, applies page numbers, and cuts the roll into proper size pages. Sheets 14 by 9 in. are assembled in booklet form (see Figs. 5 and 6 for tellurometer and instrument sheets), with 700 by 450 ft. per page.

The conventional 50 scale has 50 calibrations per inch, and with careful scaling, will yield accuracies to 1 ft. furnishing a plotting accuracy of 1:25,000 at 5 miles. Keeping the size of instant-plotting sheet at a minimum or in booklet form reduces the possibility of paper distortion.

The programing amounts to 15 man-hours per mile of line, plus or minus 3 hours, depending on the angle and number of MUS lines; the plotting and completion require 50 man-hours per mile. Computers can be used to program large systems and will save considerable time. From preliminary investigation, it appears that there is a computer capable of doing the actual plotting. In future large control systems, this computer-plotting technique will be attempted. Knowing the computer rates, the above manual programing and plotting time can be used to determine the most feasible and economical procedure.

Offshore control systems using the instant - plotting method for instruments are constructed by the same method as those for the tellurometer. Instead of plotting MUS lines, the radiated degree and minute lines are used.

Advantages and Disadvantages

Although a survey tower subject to waves or strong winds will reduce to a large degree the ability to accurately turn angles, under the same conditions, the shaking tower does not measurably affect the tellurometer distance determination. The survey instrument has the advantage of ease of use since one simple observation is required for the instant plotting, whereas with the tellurometer, four readings are taken (30 seconds total) and these must be interpreted for distance in MUS.

However, since the survey instru-

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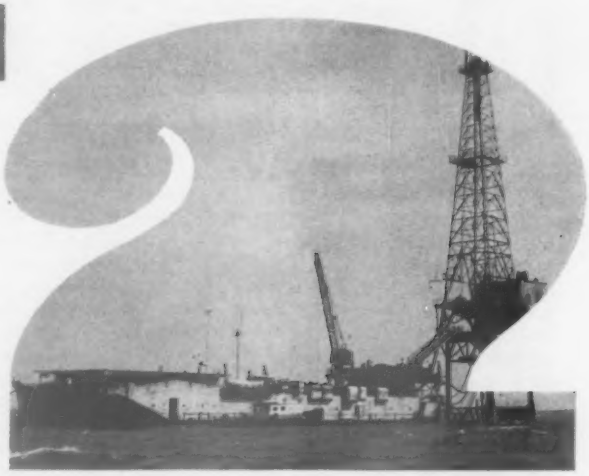
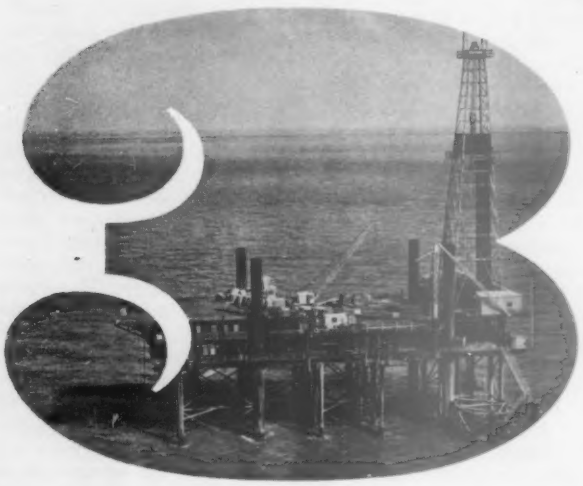


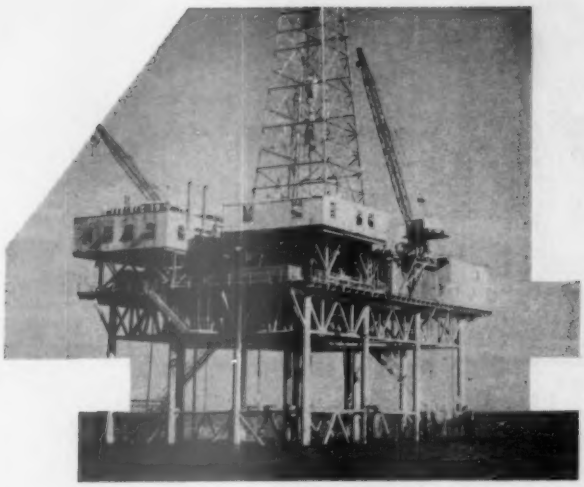
TENDER AND PLATFORM

As the second oldest method of offshore drilling, the Tender and Platform now has begun to regain its well-deserved popularity. It will become more and more prevalent in deep-water operations. The Offshore Company can provide this type of tool, including design and construction of a dependable, minimum size platform if requested, for use in water depths up to 200 feet.



SUBMERGIBLE MOBILE PLATFORM

For water depths from 15 to 40 feet, this is a rugged, economical tool for wildcats, field extensions, and widely spaced development wells. The Offshore Company's submergible is equipped with four 6-foot diameter caissons, each with a pneumatic jack to serve as spuds and prevent movement in rough seas. This added safety factor can mean the difference between success and failure in many situations.



SELF-CONTAINED PLATFORM

Oldest of offshore drilling methods, the Self-Contained Platform is still the best for some development drilling and special exploratory situations. Offshore's platform rigs have a unitized design that can be handled by a derrick barge in just six lifts, and require the minimum size self-contained platform. Such platforms are the result of Offshore's years of experience in developing and choosing the right tool for the job.

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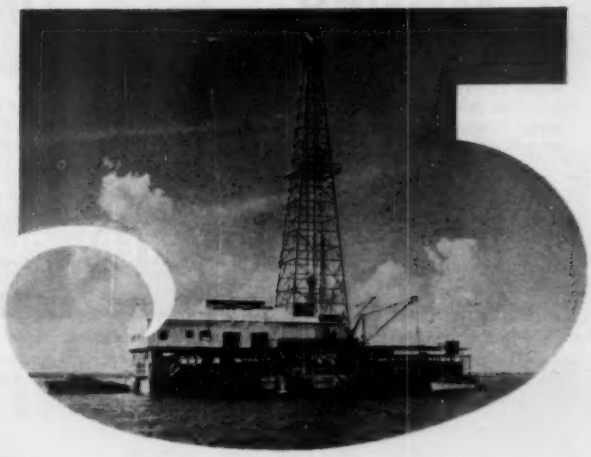

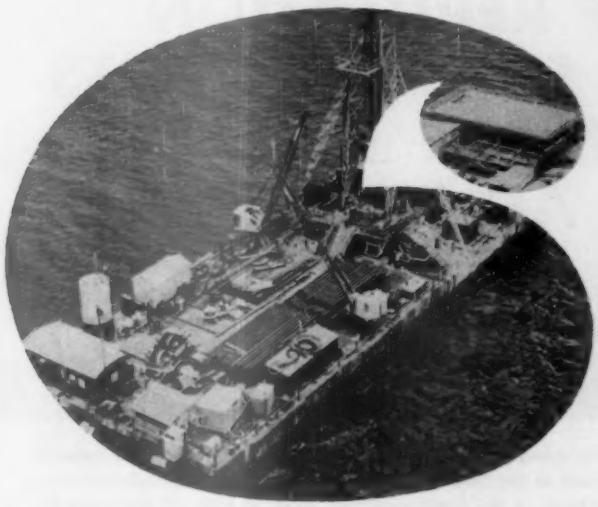

FLOATING UNIT

A recent development in marine drilling operations, this type of unit is useful for exploratory purposes in deep water. Its practical use, at present, is limited to obtaining stratigraphic and subsurface information. This unit was successfully used by Offshore on a major discovery below 10,000 feet in 100 feet of water.

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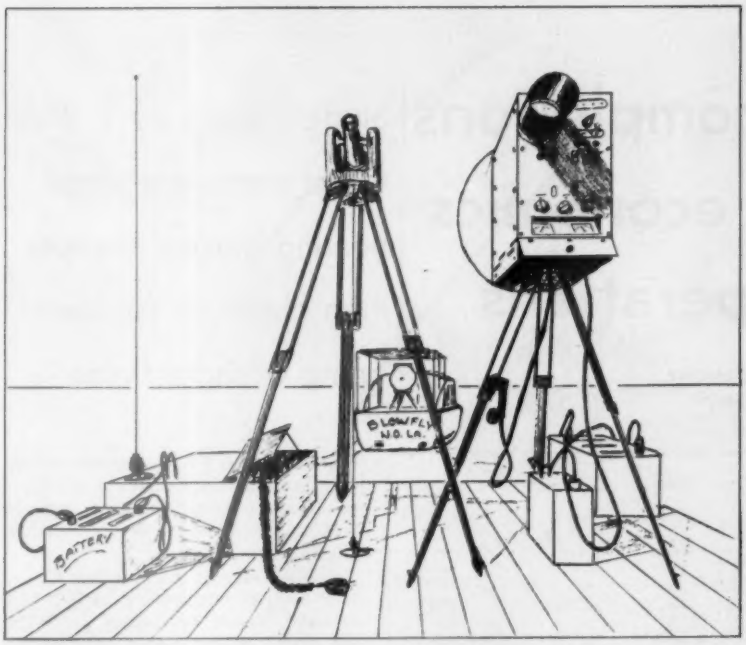


SURVEY INSTRUMENT for radiating lines and tellurometer for distance measurement is a combination for hydrographic surveying. Fig. 8.

ment is limited by visibility it is less practical for long observations. This is particularly true along the Gulf Coast where on the average for a 12-mile shot, workable time for the instrument is only 50%. The tellurometer is usable 100% of the time, regardless of fog, smoke, haze, or light rain. Inasmuch as the tellurometer and survey instrument must have line of sight, low-lying coastal areas will require sizable towers for long-distance offshore observations.

Raydist, Loran, Shorac, etc., have their advantages because their propagation wave follows the earth's curvature, thus increasing the range. However, the accuracies of these systems are less, thus limiting their use for a high-precision work.

Bilby Steel Tower

In many of the situations that call for a horizontal-control system, using either instrument or tellurometer, elevating of the personnel and equipment is necessary. The Bilby steel tower is readily adaptable for work of this type due principally to its portability—a genuine asset for job-to-job use. This tower was designed by Jasper S. Bilby in 1927, specifically for coast and geodetic triangulation work.

Complete specifications for such a tower are available in special publication No. 158, U. S. Department of Coast and Geodetic Survey, Washington 25, D. C.

The regular Bilby tower was designed with both an external tower for personnel and an internal tower for instruments; but since vibrations do not appreciably affect the accuracy of the tellurometer, only the outer tower is needed. These towers can be acquired in the various heights of 25, 77, 90, and 103 ft. With guy wires, an addition of five 10-ft. extensions can be used where additional height is needed. The erection time for one tower, after the foundation is poured, is approximately 6 hours.

The question has arisen as to the reason for building a tower rather than extending the parabolic reflector and antenna of the tellurometer. The signal loss from the reflector to the tellurometer unit is such that the range is effectively decreased. In experiments with the reflector unit raised to 40 ft., the effective range has been cut to 12 miles. The complete assembly can be purchased from Tellurometer, Inc., Washington, D. C., including antenna head, transmission cables, adapter, and necessary plugs and sockets for approximately $625. The mast proper is not included with this assembly.

Other Systems

A new unit is now available, called the Micro Dist by Cubic Corp. which, from all appearances, has additional advantages over a tellurometer due to a direct digital readout, saving interpretation time. Also, the master and slave units are interchangeable by switches on the independent units. The principle of operation and accuracies are similar to those of the tellurometer.

Tellurometer, Inc., has developed a new electronic device called "Hydro Dist," now in prototype form and expected to be completed some time in June 1960. This device is designed to operate on floating equipment, such as crew boats, etc., with claimed accuracies of 1:30,000. A computer for digital readout of cartesian coordinates will be used on these units and at present, an automatic plotting table is under development with an expected accuracy approaching 1 part in 10,000.

This new system employs unattended remote stations on shore, and will also require line of sight. Unlike the tellurometer, the Hydro Dist has various shaped and sized reflectors to be used, depending on area of coverage and distance from unattended remotes. For close-in work, a wide divergence of signal strength is required for sufficient area coverage, while for longer distances, narrow beamed reflectors give additional signal strength for the same area of coverage. The units of readout are 100 m. for the A pattern frequency, and 1,000 and 10,000 m. for C and D frequencies.

Another combination for hydrographic survey work is the coordination of a survey instrument for radiating lines with a tellurometer for distance measurement (see Fig. 9). Operating from a stationary platform, and using an instrument for alignment, a rough distance is established between the master and slave unit. The revolutions of the break on the oscilloscope are then counted with each complete revolution 1,000 MUS, or 492 ft. on the D scale. The boat is held on constant alignment by instrument, while the fathometer is marked and buoys dropped on each revolution of the D scale (or at any preset sequence).

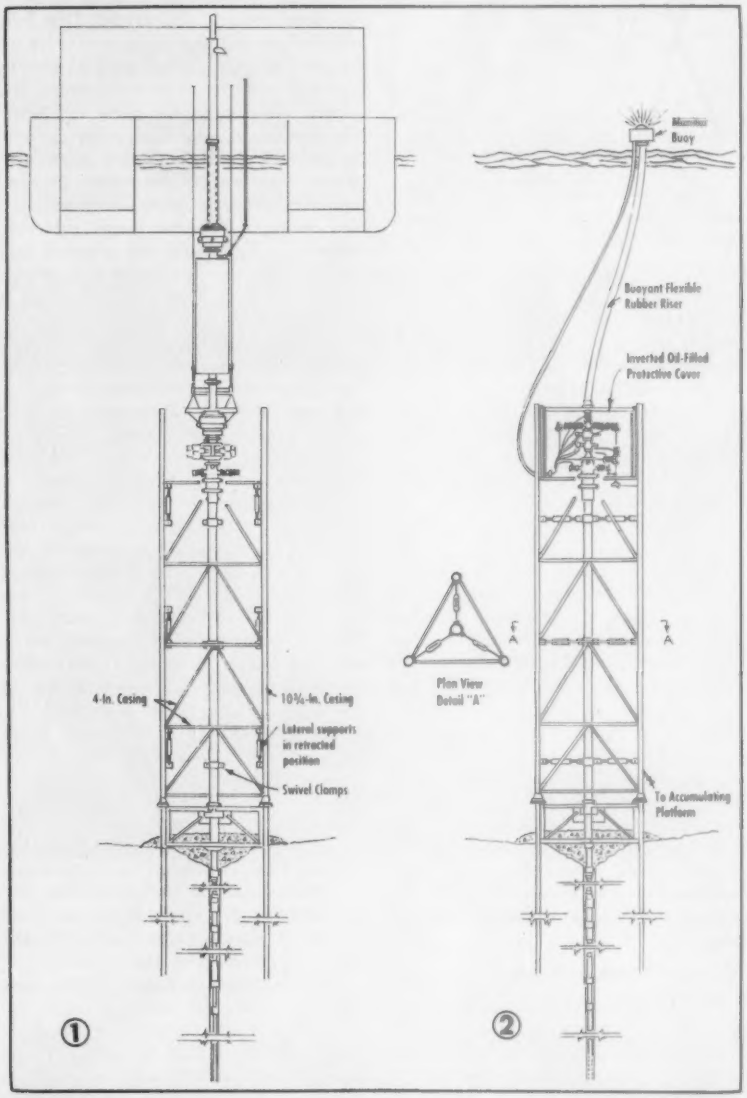
To grid an area offshore while working at a considerable distance, the boat is anchored and readings of A + D, A + C, and A + B frequencies are taken to figure approximate distance ± 250 ft. Directional movement of the boat is started, and rotations of the break in the circle on the oscilloscope are counted as described earlier. Relatively calm water is needed for an operation of this type.

For preliminary hydrographic surveys of river and bay crossings, the following is an effective arrangement. A baseline is staked at 200-ft. intervals. By setting ranges or using an instrument for alignment, cross-sections are run employing the A+, A− frequencies of the tellurometer for stationing. This A+, A− scale yields rotations once every 50 ft.

Underwater completions may improve economics of offshore operations

Studies made by a West Coast contractor show floating barges cheaper than platforms for developing offshore fields

BY D. H. STORMONT
Journal Staff



SUPPORTING STRUCTURE is guided into place over 8-in. piling and secured by pumping cement through the back valves shown at the base of each leg. Fig. 1 at left. Large-diameter rubber hose is run from the top of the christmas tree to a point above the water surface after completion. A small surface platform contains hydraulic lines for valve controls and well pressure gages. Fig. 2 at right.

UNDERWATER completions not only are possible, but for many types of offshore operations they may be more economical than conventional platforms.

Global Marine Exploration Co., a Los Angeles engineering and drilling concern which specializes in working from floating barges, reached this conclusion after detailed studies of offshore operations.

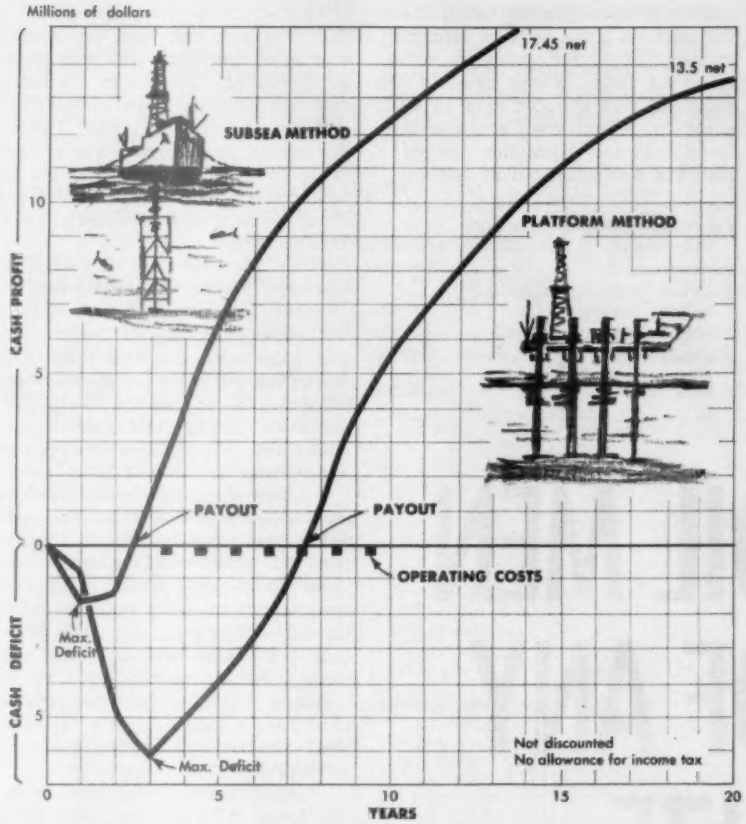
High cost of exploratory and development programs from platforms are slowing offshore operations. Floating drill barges have shown they can quickly and economically evaluate submerged oil structures. Offshore from California, in the Gulf of Paria, and in Peruvian waters, the method was quite successful, at costs comparable to similar onshore operations.

Carried out from floating barges, the subsea method of completion eliminates need for a large expenditure early in the life of a development. This and other advantages make the method more economical in relatively shallow water. They permit development in waters where depth limitations preclude use of platforms.

In the study made by Global Marine on the economics of a subsea development program versus platform drilling, the drill site was assumed to be in 100-ft. waters offshore from Santa Barbara County, California. Under these conditions, and others discussed later, the subsea method was found to offer earlier income return, earlier payout, and greater net profits.

Procedure. Before going further into the economics, one method proposed by Global Marine for completing wells subsea will be highlighted.

The drilling vessel used could be similar to its Cuss I, a 260-ft. barge rated to depths in excess of 12,000 ft. In the past 4 years this barge has been used to drill more than 200,000 ft. of hole in water depths ranging



SUBSEA COMPLETION METHOD pays out during third year while payout does not occur until the sixth year for the platform development. Fig. 3.

from 45 to more than 360 ft. Design of the vessel and its drilling equipment has made it possible to hold footage costs to a level comparable with California onshore exploratory operations.

Method of drilling from a floating vessel was discussed by Bauer, Field, and Stratton (OGJ, June 30, 1958, p. 68). In such drilling, 13⅜-in. conductor casing is set at 200-500 ft. and 10¾-in. casing at 1,000 to 2,000 ft. A casing head has been welded to the top of the 10¾-in. casing. Blowout-prevention equipment also has been flanged to the head on the vessel and the whole base assembly lowered to the ocean floor.

When the hole has been drilled to the required depth, say 5,000 to 10,000 ft., 7-in. casing is run and cemented in the same manner as an onshore completion. As the well is to be completed 50 ft. below the water surface, a left-hand collar was provided at that level for backing off the 7-in. casing after it has been cemented. All weight of the casing strings thus is supported by the structure on the ocean floor.

... While standing cemented, the blowout-preventer assembly is unflanged at the casing head and removed. A 13⅜-in. packoff riser is placed around the 7-in. casing. A standard bowl-type casing head is installed manually at the top of the riser to pack off between the two strings.

After this is done, the landing base then is secured to the sea floor by drilling or driving 8-in. piling through the three pile guides. The 13⅜-in. riser will stand free against design forces during this operation.

... Placing the supporting structure is the next step, Fig. 1. This is guided into place over the 8-in. piling and secured by pumping cement through the check valves shown at the base of each leg.

The casing riser is left unsecured within the structure to allow flexibility during the completion operation, and to prevent possible damage due to movement of the vessel. After the tubing head and blowout preventers are installed, drilling out and completion are conducted in the normal onshore manner. The tubing then is hung in a conventional doughnut hanger.

... Completing the well includes installation of a christmas tree, after the blowout preventers are removed and the tubing hung. Hydraulic control lines are installed on key valves before the christmas tree is lowered into place. A lubricator from the top of the christmas tree to the rig floor allows removal of the tubing plug. It also permits use of swabbing or other completion tools in the tubing.

Production lines may be installed for test purposes, to the drilling vessel, to another auxiliary vessel, or to a shore station. The riser and wellhead are secured to the support structure by means of three sets of adjustable supports.

... After completion, buoyant large-diameter rubber hose is run from the top of the christmas tree to a point above the water surface (Fig. 2). At the top of this buoyant support, a small platform will contain the hydraulic lines for the valve controls and well pressure gages.

One method of protecting the wellhead assembly from corrosion and marine growth would be to latch an inverted covering vessel over the top of the platform, as indicated in Fig. 2. Oil, fresh water, or another inert substance would be used to fill the vessel. The fluid would be removed and replaced through a fillup hose each time access to the wellhead is required. The completion depicted here places the wellhead structure well below violent wave actions, the most serious corrosive action, and marine fouling. That far below the surface, they likewise would be free from navigational hazards.

The wellhead is brought to within 50-70 ft. of the surface because divers can work much longer and more efficiently at this depth than at the 100-ft. design water depth.

If a platform is wanted, the structure would be extended above the surface. Otherwise the method of completion would be as previously described.

Comparative economics. Each offshore development operation has its own economic solution, depending on physical characteristics. Among these are: (1) water depth, (2) bottom conditions, (3) wave and weather conditions, (4) distance from port and shore, (5) drill depth and casing program, and (6) productivity of the field.

In the studies made by Global Marine, the site was a submerged land parcel offshore from Santa Barbara County, California. Basic assumptions for calculating the cost of a conventional platform and that for completing subsea wells from a floating vessel were as follows:

Water depth, ft.	100
Well depth, ft.	5,000
Spacing, acres per well	20
Value of oil, $	3.00
Value of gas-gasoline, $	0.30
Taxes on oil reserves, $	0.30
Recovery, primary, bbl. acre	40,000
Term, years	20
Recovery per well, bbl.	800,000
Royalty, %	*27.0

*Based on the royalty set by the state formula for a maximum of 300 bbl. per day per well, and declining to the 16⅔% minimum.

In considering the platform method it was assumed the field had been tentatively outlined by stratigraphic drilling from a floating vessel. Thus the platform could be most efficiently located. From the geometry of existing oil fields in the area, it was estimated that no more than 15 wells could be drilled from a single platform. On this basis the cost of a platform was estimated as follows:

Fabrication, including engineering and materials	$1,800,000
Placement	700,000
Facilities, including engineering, decking, housing	900,000
Piping, tankage, electric, etc.	400,000
Rig installation	200,000
Total cost	$4,000,000

Drilling costs were estimated at $120,000 per well, and the average cost of a completed well was placed at $210,000. Production operating cost was estimated to be $350,000 per well for the 20-year period. Cost of the exploration program was estimated to have added $52,000 to the per well cost. Total cost for the 15-well development thus was placed at $879,000 per well.

From the cash-flow viewpoint, the platform development would result in a maximum deficit cash position of $6,150,000. (See Fig. 3.) Payout would not occur until the sixth year. Ultimate cash profit for the 20-year operation would be approximately $13,560,000. From the rate-of-return viewpoint, the operation would yield only about 25% before taxes.

... Subsea completion method. In analyzing the subsea completion method it was assumed that in the first year 15 wells would be drilled, only 9 of which were producers. The remaining six oil wells would be drilled in the second year. Per well drilling and completion costs for these wells were estimated at $230,000. Of this amount $130,000 was for drilling, $60,000 for casing, tubing, etc., $20,000 for facilities, and $20,000 for well protectors.

Producing and operating costs were estimated at $354,000 per well for the 20-year period. It was anticipated the well flow lines would be run to a small central platform or to an onshore station.

Over-all cost of the subsea completion method was estimated to be $636,000 per well. Of this total, $230,000 was for development, $354,000 for production, and $52,000 for each of the six dry holes.

Analysis of the cash position for the subsea completion program showed that during the first year a negative cash position of $1,590,000 would develop. During the second year this would revert to a plus position of $1,450,000. In the third year the development would pay out. An ultimate cash profit of $17,450,000 would be realized, with the rate of return on invested capital indicated to be between 85 and 90%.

Compared with the platform method, it is evident the subsea method commits development expenditures only as successful wells are drilled. Each well can be programed after a study of all preceding wells. Income may begin soon after completion of the discovery well. Also, the method eliminates hazards involved in high-angle directional drilling.

The required high early investment in the platform-type operation accounts for most of the method's higher cost. However, the economics were

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not found to differ materially if the platform costs were varied 20% in either direction. Likewise, a 20% increase in the production costs of the subsea method was found to have little effect on the economic comparison.

Producing subsea completions. Where oil wells are completed in the manner shown here, Global Marine plans call for wellhead maintenance to be performed by skin divers. At the relatively shallow depth of 50 ft., it is thought they would have little difficulty.

Each wellhead would have extra adjustable flow beans external to the well protective cover. These would be operated by the pumpers as necessary. An added refinement would be to bring these controls to the surface buoy. Flow lines would be dual to the collecting station. Thus in the event of leakage or plugging, the alternate line could be used during repair.

Simple well-workover operations inside the tubing would be performed from small vessels. When it is necessary to pull tubing, an intermediate or large floating drilling rig would be used. When a redrill operation is needed, the blowout preventers would be reinstalled and the work carried out by such vessels as the Cuss I.

Kafji crude characteristics

The crude characteristics from 1 Kafji, drilled in the Persian Gulf by Arabian Oil Co. (Japanese), became available just at press time. Here they are:

Whole crude	
°API gravity	26.9
Sulfur, wt. %	2.91
Viscosity, Redwood, 30° C.	146
50° C.	86
Con carbon, wt. %	8.8
Dry gas, vol. %	0.68
Gasoline (i.b.p.-300° F.)	
Yield, vol. %	13.0
°API	71.7
CFRR, clear	50.1
2 ml.	69.1
Doctor	negative
Kerosine (308°-475° F.)	
Yield, vol. %	15.3
°API	47.7
Sulfur, wt. %	0.2
Smoke point, treated	26.0
Gas oil (475°-572° F.)	
Yield, vol. %	9.1
Sulfur, wt. %	1.02
Diesel index	58.2
Cetane number	55.2
Pour point, °F.	0
Reduced crude (572° F.+)	
Yield, vol. %	61.9
Sulfur, wt. %	4.15
Con carbon, wt. %	1.5
Pour point, °F.	77
Viscosity, Redwood, 50° C., min.	2,700

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A fresh look at

The Isomerate process

Since it was first announced in 1956, Pure Oil Co.'s Isomerate process has undergone extensive development work. Here are some of the latest details.

BY HOLLIS O. FOLKINS AND HARVEY HENNIG

. . . section leader in catalytic and process research at the Pure Oil research at Crystal Lake, Ill. He joined Pure Oil in 1939 after receiving his doctorate in physical chemistry from McGill University, Montreal. Folkins has been concerned principally with research in petroleum and petrochemical processes. He is the author of various papers in these fields and is the recipient of around 50 patents.

. . . supervisor of process engineering and evaluation section at Pure's research center. He joined Pure in 1941 as a junior research engineer, worked on petroleum refining and petro-chemical proc[illegible] research and development, is inventor or coinventor of 12 U. S. patents, and coauthor of an article on Pure's carbon disulfide process. He received his M.E. degree in general engineering from Stevens Institute.

C_5/C_6 charge stock to the Isomerate process can be upgraded by any of several processing schemes. It operates at high yields per pass with a product which approaches equilibrium distribution for isopentane and for the branched-chain hexanes.

The commercial process for n-pentane is designed to operate with about 60% of isopentane appearing in the reactor liquid product with an ultimate efficiency of 99%. Research octane number of the isopentane product is about 105 with 3 ml. of TEL per gallon.

In addition, Isomerate from n-hexane or mixed-hexane feed rich in n-hexane contains from 72-75% isohexanes in the C_6 fraction with reaction selectivities ranging from 95 to 99%, depending on the feed and processing scheme. On single-pass operation, stocks high in n-hexane are isomerized to a product having a leaded research octane number of about 93 with ml. TEL.

Naphthenes, normally present in pentane and hexane feed stocks, are handled readily and the ratio of isomers of the C_6 naphthenes in the product is that predicted by thermodynamic equilibria of the naphthenes.

Economic studies for the three cases under consideration show that direct costs range from 4.2 to 5.6 cents per research-octane-number increase per barrel.

Heart of the process is an active hydrogenation metal catalyst which selectively isomerizes normal pentane and normal hexane to their respective high-octane-rating isomers at relatively low temperatures, compared to those used in catalytic reforming.

The process operates in the presence of hydrogen or hydrogen-rich gas such as catalytic reformer tail gas. Only minor quantities of hydrogen are consumed in side reactions, since the main purpose of hydrogen is to prevent catalyst fouling and deactivation. Recycle gas ratios are considerably lower than those used in catalytic reforming, while space velocities are much higher.

High Isomerate yields can be produced for long processing cycles without need of catalyst regeneration; thus regeneration is unnecessary in normal operation. On the other hand, should an operational upset occur which would result in catalyst deactivation or fouling, the catalyst may be regenerated easily.

Some reactor feeds must be desulfurized to maintain optimum catalyst activity, but feeds containing small amounts of sulfur can be tolerated by operational adjustments.

Processing Schemes

The process offers a choice of processing schemes adaptable to a specific application. The simplest case calls for handling C_5-C_6 fractions of straightrun gasoline simultaneously in one reactor as shown by the flowsheet in Fig. 1.

Deheptanized feed stock is fractionated to remove isopentane overhead as product and the resultant C_5-C_6 fraction is passed through the Isomerate reactor. The debutanized reactor effluent is fractionated to provide a recycle stream of n-pentane. In this arrangement, reaction conditions are generally adapted to the more reactive hexanes; hence lower conversions per pass of n-pentane may result.

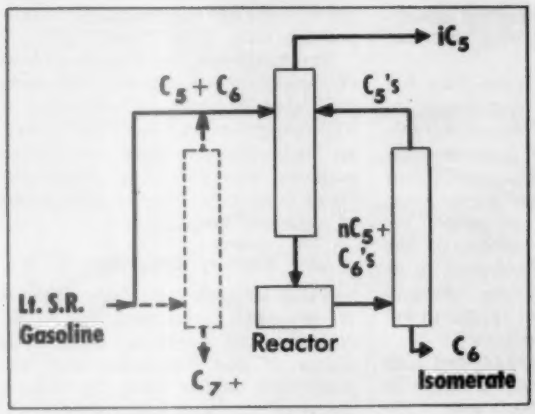
Because of different reactivities and optimum operating conditions for the pentanes and hexanes, it is often preferable to process the C_5 and C_6 fractions in different reactors. Fig. 2 shows several general schemes.

First, debutanized light straightrun gasoline is deheptanized, followed by splitting the C_5-C_6 fraction. The pentane fraction then is split to produce an isopentane product and a n-pentane reactor feed. The degree of fractionation determines the product octane number, since the n-pentane is recycled to extinction.

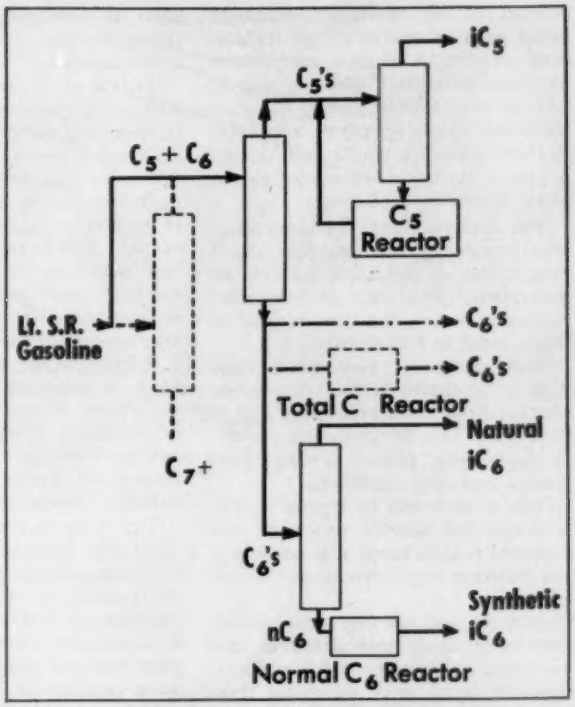
The hexane fraction may be employed directly in gasoline blending as shown by the dotted line in Fig. 2, or it may be isomerized by one of two methods also shown in Fig. 2.

In one method, hexane fractions, high in n-hexane, can be improved by direct single-pass isomerization without prefractionation. For further octane improvement, however, it is generally preferred to fractionate the isohexanes overhead to product and isomerize the n-hexane in a single-pass operation, as shown by the solid lines in Fig. 2.

Still further octane improvement,



ONE PROCESS SCHEME handles the C₅-C₆ fractions of straightrun gasoline simultaneously in one reactor. Fig. 1.



IN ANOTHER SCHEME the hexanes may go to gasoline blending, the total fraction may be isomerized, or the iC₆'s may be split out and only the nC₆ fraction isomerized. Fig. 2.

not shown in Fig. 2, is possible by recycling the n-hexane to extinction. This, however, requires an extra fractionation step, or separation of n-hexane by molecular sieves, to prevent buildup of methylcyclopentane in the recycle stream.

Effect of Feed Composition

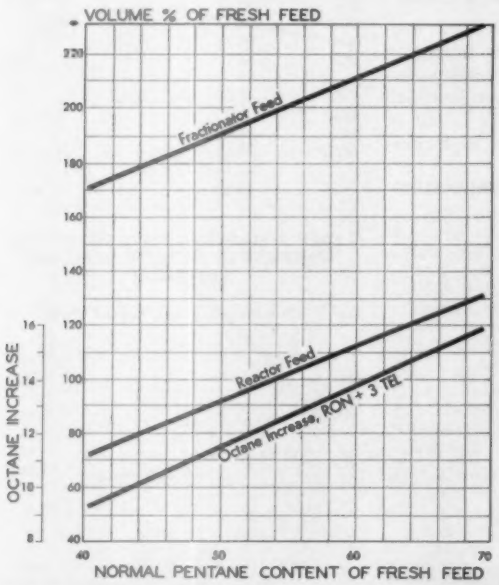
The degree of octane improvement depends upon the percentage of n-paraffin in each of the feed stocks. Octane increase is greater the higher the percentage of n-paraffin in the straight-run gasoline fraction.

Fig. 3 shows this relationship for pentanes where octane increase, volume of fractionator feed, and volume of reactor feed are related to composition of the charge stock. The relationships are nearly linear and are based on a product containing 95% isopentane and on a reactor feed containing about 8% isopentane.

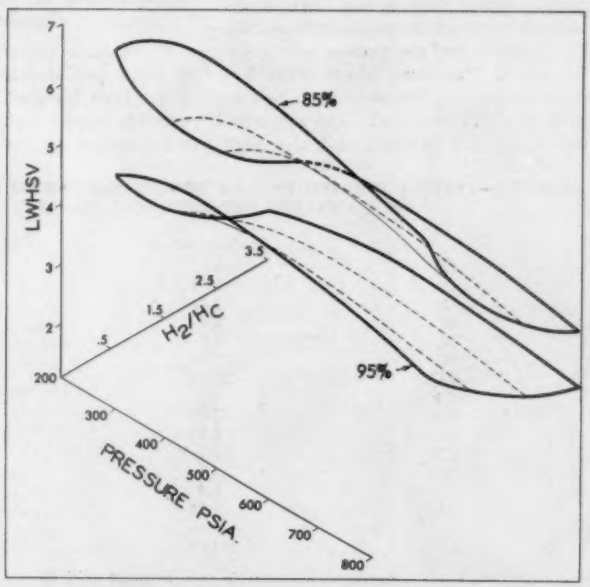
Since neither investment nor operating costs are linear with increase in reactor size or fractionator feeds, lowest cost per octane increase will be shown for feed stocks highest in normal paraffin content.

Catalyst and Nature of Reaction

The Isomerate catalyst is a dual functional type containing a small



OCTANE IMPROVEMENT depends upon the percentage of n-paraffin in the charge. Here octane increase, fractionator feed, and reactor feed are related to the charge-stock composition. Fig. 3.



REACTOR-DESIGN relationships. The two contour surfaces represent constant values of the ratio of isopentane to n-pentane in the reactor-outlet stream. Fig. 4.

amount of an active hydrogenation metal incorporated in a high surface-area support. A catalyst composition has been formulated which is rugged, and has high activity. Using it, paraffin isomerization selectively approaches thermodynamic equilibrium at temperatures far below those used in catalytic reforming processes.

The catalyst permits nonfouling-type processing and therefore allows long cycles of operation without regeneration. However, if temporary poisoning occurs, the catalyst may be regenerated to full activity.

Such poisoning may result from high sulfur content in the hydrocarbon charge, from coke precursors due to temporary loss of hydrogen recycle, or from long process cycles under drastic operating conditions.

The catalyst can be regenerated by a simple but specific procedure and repeated regenerations will not impair the inherent high activity of the catalyst.

Activity and life tests were carried out using straightrun fractions and blends containing naphthenes in amounts equal to or exceeding those normally expected in feed stocks produced by fractionation.

Table 1 shows typical product distribution and yields when processing a C_5-C_6-C_7 mixture. Milder processing condtions were used than are normally used in processing pentane fractions only.

In any catalytic-reaction system for hydrocarbons, conversions of feedstock components are related to the reactivities of the components. This fact is shown here in the lower-than-normal yield of isopentane from the C_5 fraction, and the poorer selectivity for the C_7 fraction, where some hydrocracking to hexanes and lighter hydrocarbons occurred. The apparent selectivity for hexanes and the high ratio of isobutane to normal butane shows the high isomerizing character of the catalyst.

Typical data from pilot-plant life tests of a simulated commercial n-pentane feed stock are shown in Table 2. Results shown are from the last 100 hours of a 1,600-hour continuous operation during which no decrease in activity with time on stream occurred. The hexane content of the feed stock was isomerized close to its thermodynamic equilibrium. A similar isomeric distribution applies to butane content of the products.

Table 3 shows typical life-test data from a n-hexane fraction high in naphthene content where over 73% of branched hexanes appear in the hexane fraction. Again the small amount of hydrocracking results in valuable isopentane and isobutane.

Fig. 4 shows the reactor-design relationships between three fundamental variables and the equilibrium approach for pentane isomerization at a temperature of 750° F. The two contour surfaces, each representing constant values of the ratio of isopentane to n-pentane in the reactor outlet stream, are plotted in three-dimensional space with the independent variables being (1) liquid-weight hourly space velocity, (2) hydrogen-to-hydrocarbon mole ratio (H_2/HC) of the feed, and (3) total pressure. For each surface there is an optimum pressure which depends on the H_2/HC ratio and smaller reactors are required as the H_2/HC ratio decreases over the range shown.

Road Rating of Isomerate-Blended Gasolines

To evaluate the effect of Isomerate on road performance, several series of gasolines blended to three levels of research octane rating were tested in seven makes of cars with high-compression engines of nominal 10:1 compression ratio. (Figs. 5 and 6.)

Results showed that a gasoline blend of Isomerate and catalytic reformate gave superior road performance. A 97.5-research-octane blend of Isomerate and reformate gave road-octane numbers superior to a 100-octane blend containing high concentrations of aromatics and olefins.[1]

Refinery Application

Three alternate processing schemes are presented to compare process investment and operating costs. The choice of one installation over the others will depend upon the requirements of the individual refinery.

The three cases chosen are summarized in Table 4. All examples shown are based upon a straightrun fraction fairly rich in branched-chain pentanes and hexanes, as shown by the octane number of the total respective feeds. Installation capacities are designed for a total C_5-C_6 feed stock of around 10,000 bbl. per calendar day.

Case considers isomerization of the pentane fraction only. It is attractive for the refinery which has difficulty in meeting premium-gasoline specifica-

TABLE 1—TYPICAL DISTRIBUTION OF COMPONENTS FROM ISOMERIZATION OF A MIXTURE CONTAINING C_5-C_6-CH-C_7

	Product, wt. %	Feed, wt. %
C_1	0.02	...
C_2	0.03	...
C_3	2.4	...
iC_4	2.2	...
nC_4	0.8	...
iC_5	26.59	0.6
nC_5	25.59	51.3
CP	0.9	1.1
iC_6	21.29	0.4
nC_6	8.14	28.5
CH	1.2	9.4
iC_7	2.5	1.8
nC_7	0.4	5.6
MCP	7.94	1.3
	100.00	100.0

	Average conversion, %	Average yield, %	Average sel., %
C_5	50.8	50.7	99.8
C_6	72.1	74.5	103.3
C_7	92.5	~23	~25
CH	88	~70	~80

TABLE 2—DISTRIBUTION OF HYDROCARBONS IN PENTANE REACTOR EFFLUENT

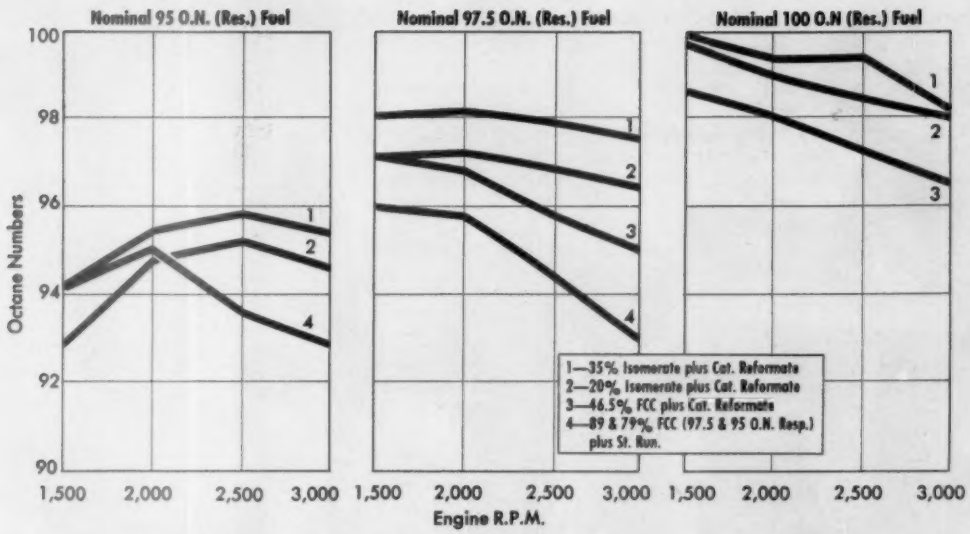
	Last 100 hours of 1,600-hour run		
	Total product	Pentane fraction	
	Wt. %	Wt. %	Vol. %
C_1	0.19	..	...
C_2	0.12	..	...
C_3	0.34	..	...
iC_4	0.17	..	...
nC_4	0.32	..	...
iC_5	50.98	57	57.3
nC_5	38.50	43	42.7
CP	5.08	100	100.0
iC_6	3.05	..	...
nC_6	1.05	..	...
MCP	0.19	..	...
	100.0		

TABLE 3—DISTRIBUTION OF HYDROCARBONS IN HEXANE REACTOR EFFLUENT

(1,500-hour life test, impure feed)

	Wt. %
C_1	0.08
C_2	0.14
C_3	0.96
iC_4	0.68
nC_4	0.38
C_5	*3.96
iC_6's	†53.28
nC_6	19.42
MCP	17.70
CH	2.81
C_7+	0.59
	100.0

*No. C_5's in feed.
†73.3% iC_6's in paraffinic C_6 group.

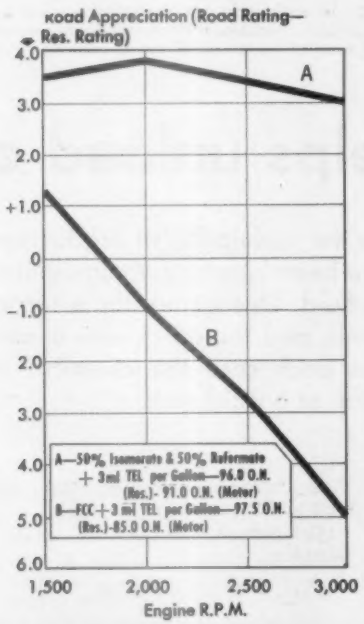


LESS-SENSITIVE FUELS, composed of isomerate and reformate, are superior to more sensitive fuel blends especially at higher research octanes and higher engine speeds. Fig. 5.

tions, since it provides a paraffinic high-octane volatile blending stock.

To the refiner whose prime need is to raise the octane number of his gasoline pool, Case 2 will prove the most economical. In this adaptation the hexanes are split, and the n-hexane is isomerized on a once-through basis.

For maximum upgrading of straight-run naphthas, isomerization of both pentanes and hexanes is required. Case 3 summarizes costs for a unit of 10,000 bbl. per calendar day of product capacity in which n-pentane is isomerized to extinction and n-hexane is processed on a once-through basis. This case also includes the cost of a C_5-C_6 feed fractionator.



ROAD PERFORMANCE of the experimental Isomerate blend was much superior, although it had the lower research octane rating of the two blends. Fig. 6.

These three cases show that direct costs range from 4.2 to 5.6 cents per research-octane-number increase per barrel. Costs, including a 3-year payout before taxes, are expressed also by increased value of product over feed stock in terms of cents per gallon and in cents per octane number increase per barrel.

Choice of installation, again, will be influenced by whether the refiner's prime need is to improve the octane rating of his gasoline pool or to produce a high-octane blending stock for premium gasoline.

Acknowledgement

Acknowledgement is accorded Arthur G. McKee Co. for process design, capital-cost estimates, and utility requirements which form the basis for the estimates presented in this paper, and to O. L. Beber, N. L. Carr, and E. L. Miller who were responsible for a major part of the experimental work.

Reference

1. Finnigan and Percy, "New Concept in Use of Blending Stock," The Oil and Gas Journal, June 25, 1956, p. 84.

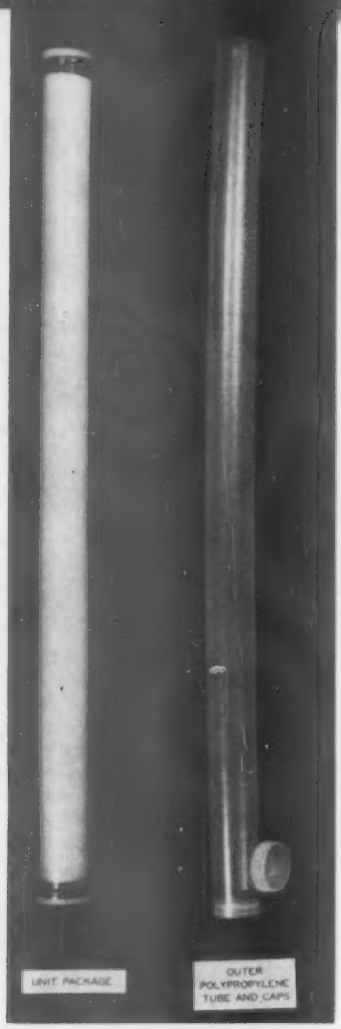
TABLE 4—C_5 vs. C_6 ISOMERIZATION

Case	1	2	3
Processing scheme	Recycle C_5 Isom. + C_5 Splitter + Stabilizer	Once-thru C_6 Isom. + C_6 Splitter + Stabilizer	Recycle C_5 + once-thru C_6 Isom. + Splitters + Stabilizers + C_5-C_6 fraction
Product—BPCD	4,000	6,000	10,000
Research octane number (with 3 ml. TEL)			
Feed, total	95.9	86.0	90.0
Feed, reactor	...	81.6	...
Product, total	105	92.8	97.7
Product, natural isomer	...	94.4	...
Product, synthetic isomer	...	91.9	...
Investment	$1,820,000	$1,250,000	$3,715,000
Operating costs, direct*			
$/CD	1,859	1,576	4,084
Cents per gallon product	1.1	0.6	1.0
Cents per Δ RON-B (+3 ml. TEL)	5.4	4.2	5.6
For an assumed 3-year payout, before taxes, increase in value of product is:†			
Cents per gallon product	2.2	1.1	1.9
Cents per Δ RON-B (+3 ml. TEL)	10.7	7.5	10.9

*Utility costs are:

Fuel	$2.10/B (FOE)
Steam	$0.60/1,000 lb.
Water	$0.02/1,000 gal.
Electricity	$0.01/KWH

†Also includes local taxes and insurance, and overhead.



SURFACTANT "FOAMING STICK," left, being dropped into well, and calcium hydride unit, right, are two recent developments The foaming stick converts water to foam at the bottom of the well, and the calcium hydride unit forms large volumes of in a well, developing a gas-lift effect. Expensive mechanical swabbing can be eliminated in a lot of cases now as . . .

Chemical application helps unload oil,

CONVENTIONAL SWABBING of oil and gas wells that have gone off production is a relatively slow and expensive operation. And it is not without hazard.

Recent laboratory work has led to the development of two new chemical applications that do the work of a swabbing unit without the normal consumption of time and money. These are (1) a calcium hydride unit that creates a "gas-lift" effect at the bottom of the well and (2) a solid surfactant that induces foaming.

Here are two advancements in the stimulation of production from oil and gas wells that have been killed by accumulation of water, oil, or well-treating fluid. One generates a large volume of gas at bottom of well, and the other uses a surfactant to induce foaming. In each case the chemical is dropped into the well in the form of a rigid stick.

Calcium Hydride Units

These were developed in an attempt to provide a simpler and less-costly means of restoring production in wells that have become loaded with water, heavy oil, or some well-treating fluid left in the hole after remedial work.

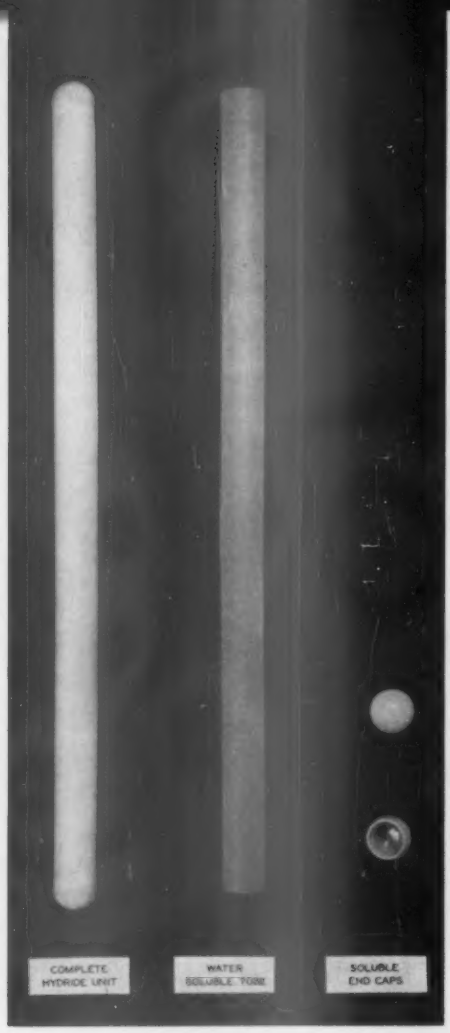
The hydride units operate on the principle of gas lift. Gas is generated near the bottom of the column of fluid in the well, and the entire fluid column is lightened as the gas makes its way to the surface. The aerated column then has a sufficiently reduced hydrostatic head to permit the well to flow again.

The chemistry involved is not too complex:

$$CaH_2 + 2H_2O \rightarrow Ca(OH)_2 + 2H_2$$

One pound of calcium hydride will produce about 18 cu. ft. of hydrogen at atmospheric pressure and normal surface temperatures. Hydrogen is an excellent lifting gas since it has a low

Presented at the national meeting of the American Chemical Society, at Cleveland, April 1960, under the original title, "New Oil-Well Swabbing Techniques."



for curing the ills of "sick" oil and gas wells. hydrogen gas to lighten a column of fluid

gas wells

BY K. J. LISSANT AND G. J. SAMUELSON
Petrolite Corp., St. Louis

molecular weight, is relatively insoluble in both water and oil, is noncorrosive and nontoxic, and does not liquefy at any combination of temperature and pressure likely to be encountered in an oil well.

Calcium hydride is a light gray solid with a specific gravity of 1.7 to 1.9. In finely divided form it has an apparent density near that of water. Except for its great reactivity with water, calcium hydride is quite stable. It does not inflame when dropped into water nor when heated to a dull red heat in an open crucible. When ignited, it burns quietly. The reaction with water is highly exothermic and in storage precautions similar to those used for quicklime or calcium carbide should be used.

Packaging problem. In the development of the hydride well-treating unit, the most difficult problem was to devise a method of delivering the hydride to the proper place in the fluid column before permitting reaction with water. This is basically a packaging problem. The package, however, has to have some very peculiar properties.

The nature of the problem suggested a cylindrical container about 1.25 in. in diameter and about 24 in. long capable of withstanding the impact on striking the fluid column after falling several hundred feet down the open portion of the pipe. It must fall through several hundred feet of oil and finally dissolve or disperse completely in the water or brine at the bottom of the well within a period of about an hour. It further must not become brittle during storage at near zero humidity for several months. These are stringent requirements.

The packaging material that was finally found to meet most of the requirements was a high-molecular-weight polyethylene glycol. This is a tough, hornlike, thermoplastic which can be molded, extruded, and heat-sealed. It does not become brittle in very dry atmosphere.

In final form the unit is prepared as follows: High-molecular weight polyethylene glycol is extruded in the form of a continuous tube, 1.25 in. in diameter and 30 mils wall thickness. This is cut into 24-in. lengths and a bullet-nosed, molded end-cap of the same material is heat-sealed into one end of the tube.

The tube is then filled with a mixture of 300-mesh barium sulfate and 40 to 300-mesh calcium hydride. The powder mixture is vibrated to compact it and the top is sealed with another end-cap. Each unit contains 1 lb. of hydride. The filled units are then sealed into extruded polypropylene tubes, which provide an effective barrier to moisture and water vapor.

Simulating conditions. Laboratory simulation of conditions encountered in oil wells is difficult. We have, however, devised suitable apparatus for determining the rate of fall of the swabbing units in various fluids and also for determining the time required for disintegration of the casing in water and in oil-field brines.

In 2-in. tubing, the units fall at a rate of about 100 ft. per minute in water or nonviscous oils. We have not been able to get accurate determinations of the rate of fall in "open hole," that is, in tubing filled only with gas or vapor. Estimates based on field tests where the time of fall in actual wells was measured indicate that the terminal velocity of a unit falling in 2-in. tubing is of the order of 100 ft. per second.

The hydride units will fall through fresh water for about 30 minutes before the water begins to penetrate the casing and react with the hydride. The time for reaction is longer in brines. In 10% NaCl with 1% $CaCl_2$ the reaction time is about 45 minutes. Once the water penetrates the casing, the reaction is rapid. In most cases the reaction is complete in less than 1 minute.

In tests where the units were first soaked in crude oil to simulate falling through an oil column before reaching water, the oil was found to wash off rapidly as soon as the unit began to fall through water. The time for water to penetrate the previously oil-wet casing was not affected significantly.

The results of tests on actual oil wells have shown reasonable agreement with laboratory tests. The falling rates and delay times seem to be of the same order of magnitude. As previously stated, 1 lb. of calcium hydride will evolve about 18 cu. ft. of hydrogen. This is approximately equivalent to 3 oil-field barrels or to the volume of about 780 ft. of 2-in. tubing.

If the gas lift were 100% efficient we would expect one unit to displace about 3 bbl. of fluid out of a well. Based on field experience, hydrogen is about 75% efficient as a lifting agent, and we have established as a rough rule of thumb that one unit will empty 500 ft. of a 2-in. tubing.

An estimate of the amount of fluid to be removed from the well can be made from experience with previous swabbing operations, or from bottom-hole pressure data. This volume and the amount of open hole will determine the number of sticks required to clean the well.

Before using the sticks, the well is open to a tank or pits. The sticks can then be dropped into the well in succession, each stick being allowed to reach the fluid before the next is dropped. But, all should be dropped in as short a time as possible.

The well is left open to the pits until the units react. This will take from 1 to 6 hours, depending on well conditions. Back pressure on the well should be avoided until it is certain

that the well has thoroughly cleaned itself out.

Difficulties. Field tests have shown that the hydride units have wide applicability. However, difficulties have been encountered. Data in Table 1 are from tests where there were problems, tests where the method failed, and tests which were successful in restoring production.

The first three examples in Table 1 illustrate instances where the expected amount of fluid was displaced from the well, but the formation pressure was not high enough for the well to resume flow. Still, these tests supplied the operators with useful information at less cost than conventional swabbing jobs.

If there is no water in the tubing, or if there is an obstruction in the tubing above the water column, the units cannot be expected to react. In several successful cases, water has been deliberately added to the well to react with the units.

Example 4 of Table 1 is an instance where a conventional swab had been lost in the well and was lodged above the water level.

Example 5 is a case where there was no packer in the well. Thus, most of the gas escaped up the annulus without displacing enough fluid to reactivate the well. It was not known that the packer had been left out during a workover operation. Theoretically, the units can be used to displace fluid from both the tubing and the annulus; however, the number of units required may make this uneconomical.

Unless the units fall below the fluid which they must displace before reacting, they cannot perform their function. For this reason we have selected a wall thickness for the water-soluble package which will give a delay time of at least 30 minutes after the units reach water. This will allow them to fall nearly 3,000 ft. into the water before reacting. Examples 6, 7, and 8 are taken from some of our early tests where the units reacted too soon and so did not displace their full capacity.

The rest of the examples represent successful tests. Wells varying in depth from 3,000 to 12,000 ft. have been reactivated. Note that the delay time increases with the depth of the well. The units are apparently strong enough to stand a fall of several hundred feet before striking fluid. Where there is over 1,000 ft. of open hole, we recommend lowering the units to fluid on a wire line. Techniques for doing this are under consideration. On the basis of experience to date we find that 2,500 to 3,000 ft. of 2-in. tubing can be emptied for about $100.

Foaming Sticks

The second method of well rejuvenation is more limited in application since it depends for its action upon the gas produced by the well. Actually it is an improvement on well-established older methods.

Many gas wells have a tendency to load up with water and condensate to the point where either they will no longer produce or their production is seriously curtailed. It is a common practice to blow gas wells occasionally to remove accumulated fluids. This practice results in a loss of gas, a fire hazard, and possibilities of damage to the formation reservoir. It is generally conceded that blowing of wells should be kept to a minimum.

The use of surfactants to increase the foaming tendency of the well fluids is well known. Until recently, however, the available surfactants were not suitable for use in extremely hard waters or brines. The great increase in the commercial production of the nonionic surfactants has made available a class of compounds well suited to this application. Dunning and Eakin in a recent article[1] point out the application of liquid surfactants to the foam blowing of gas wells.

Early in June 1958 we conducted a field test on a gas well in northern Louisiana using a liquid oxyethylated phenol with very satisfactory results. We were able to cut the time required to blow the well to less than a third of the usual time, and the well showed higher pressures and increased production. It also took longer to load up again. But we concluded that the use of liquid surfactants or solutions of surfactants presented some distinct drawbacks.

As noted in the article by Dunning and Eakin, the surfactant must be flushed down the well pipe to the fluid level and then mixed with the well fluids by "rocking" the well. It was decided, therefore, to try to develop a surfactant stick which would dissolve while falling through the fluid column and thus eliminate the need for using alcoholic solutions, flushing the material down the well, and mixing the material through the fluid column.

A number of oxyalkylated phenols of sufficiently high molecular weight to be solid at room temperature were made. These materials were melted and poured into spiral-wound cardboard tubes equipped with bullet-nosed metal end caps, and allowed to cool. The resulting sticks were about 1.25 in. in diameter and 20 in. long and contained the equivalent of 1.25 pt. of liquid detergent. They were tested in the laboratory falling-rate apparatus and were found to fall in fresh water at about 85 ft. per minute. At 70° F. a stick took about 40 minutes to dissolve while falling through fresh water, while at 140° F. it dissolved in about 10 minutes. In brines the time for solution was not over 10% longer.

Field tests of these sticks in actual gas wells have been very encouraging. The time needed to unload a well is usually cut to less than half and in many cases to less than a quarter of the time needed without surfactant. It has not proved necessary to rock the well. Since considerable wax and other solids are also flushed from the well, the wells often show an increase in production and in pressure after treatment.

It should be strongly emphasized that these surfactant sticks are of use only where the well is producing gas. No gas is generated by the stick and the formation of foam is dependent upon the gas from the well. In actual use very little persistent foam is produced from the wellhead. The fluids

TABLE 1—FIELD TESTS ILLUSTRATING USE OF HYDRIDE UNITS

Test No.	Location—	Depth	B.h.p., psig.	Fluid level	No. of units	Results
1.	Caillon Island	13,574	....	tree	6	14.2 bbl. of fluid in 50 minutes. Well did not flow.
2.	Southern Arkansas	7,800	....	300	3	8 bbl. of oil. Well did not come in.
3.	Bay City, Tex.	....	....	600	8	9 bbl. out against 50 psi. back pressure.
4.	Gueydan, La.	9,840	4,400	2,000	7	No action; swab in hole.
5.	Lafayette, La.	11,086	4,392	1,800	8	No packer. Got pressure on casing.
6.	Offshore in Gulf	8,636	3,983	tree	7	2 bbl. Premature firing.
7.	Paradis, La.	8,700	2,800	250	5	Stress cracks in units. No action.
8.	Tambalier Bay, Louisiana	11,990	5,451	300	10	3.4 bbl.—no flow.
9.	Caddo Parish, Louisiana	2,795	985	520	5	Came in about 1 hour after dropping.
10.	St. Martin Parish, Louisiana	6,700	2,640	tree	5	Came in about 2.5 hours after dropping.
11.	Leeville, Ark.	12,600	6,143	tree	8	Came in after 6-8 hours.

that are blown from the well are usually in the form of a fine spray. In cases where there is considerable condensate the produced fluid may be an emulsion of condensate in water. Enough surfactant should be used to insure good foaming. Field tests indicate that about one stick per barrel of fluid to be lifted is a minimum figure. The condensate in the well seems to act as an antifoam agent and where there is a high condensate-to-water ratio proportionately more surfactant should be used.

Field examples. Well "A" had a pressure differential of 28 in. of mercury when first brought in but this had fallen to 12 in. just before the test was conducted. Two foaming sticks were dropped into the well and the well was shut in for 30 minutes. It was then blown to the pit for 30 minutes and was put back on the line at a 28-in. pressure differential which it held for 10 days before decline began.

Well "B" was a gas-condensate well in Texas which showed 300-psig. pressure and almost no gas flow. Two sticks were introduced into the well and the well was blown for 1 hour. It was then put back on the line at 340 psig. with 74 in. of mercury differential.

Well "C" was producing 3.5 M.M.c.f.d. at 900 psig. on a 1-in. adjustable choke. It was treated with six sticks and shut in for 30 minutes. At that time it would not buck the line pressure. It was blown to the atmosphere for 25 minutes and produced only dry gas. The pressure dropped to nearly zero. At this point the well began to unload. After an additional hour it had produced 10 bbl. of distillate and 4 bbl. of water. Fifteen hours later the well was flowing 3.85 M.M.c.f.d. on a 1-in. choke against 875 psig., after having made 10 bbl. of distillate and 30 bbl. of water.

Well "D" had a depth of about 800 ft. and was producing 108,000 cu. ft. per day at 4 psig. One stick was introduced into the well, followed with a swab on a wire line. About 5 gal. of liquid was removed with the swab. The well was then blown to atmosphere for 3 to 4 hours, after which it was put back on the line. Fourteen days later it was still making 260 M.c.f.d. at 14 psig.

Field tests show the foaming sticks to be comparable in effectiveness to liquid surfactants and much more convenient to use.

Reference

1. Dunning, H. N., and Eakin, J. L., "Foaming Agents Are Low-Cost Treatment for Tired Gassers": The Oil and Gas Journal, p. 108, February 2, 1959.

Book reviews

New book develops concepts of . . .

Physical Properties of Petroleum Reservoirs

PETROLEUM RESERVOIR ENGINEERING—Physical Properties, is the first of two volumes on reservoir engineering by James W. Amyx, Daniel M. Bass, Jr., and Robert L. Whiting, Department of Petroleum Engineering, Agricultural and Mechanical College of Texas. It develops the fundamentals of rock and fluid properties on which reservoir engineering is based.

The introduction covers the general aspects of composition of petroleum, physical properties of hydrocarbons, origin of petroleum, traps, petroleum reservoirs, drilling, well completion and production, and reservoir performance.

Fundamental properties. The chapter on fundamental properties deals with porosity, permeability, fluid saturations, and electric conductivity of fluid-saturated rocks. Porosity is covered from the standpoints of laboratory measurement, precision of measurements, and compressibility of porous rocks.

Points covered on permeability factors are types of flow, combination layers, channels and fractures in parallel, analog of physical laws, measurement, and use of core-determined fluid saturations.

Multiple saturations of porous media. This deals with surface forces, capillary pressure, effective permeability, and relative permeability. Individual topics are (1) fundamentals of surface and capillary forces, (2) laboratory measurements of capillary pressure, (3) interstitial water saturations, (4) calculation of wettability, (5) pore-size distribution, and (6) calculation of effective and relative permeability.

Hydrocarbon behavior. The fundamentals of single-component, binary, and multicomponent systems serve as introduction to properties of gaseous and liquid states, and of two-phase systems.

Two-phase system properties include equilibrium relations, development of equations for calculating equilibrium relations, and separator problems.

Reservoir fluid properties. This topic is introduced by a discussion on sampling reservoir fluids, including bottom-hole, recombination, and split-stream sampling.

Concepts developed in the laboratory analysis of reservoir-fluid samples are relative total volume, formation-volume factors, flash-separation test, gas compressibility, fluid viscosity, equilibrium ratios, fluid composition, and presentation of a fluid analysis for a gas-crude-oil system.

These things are necessary in the preparation of fluid-analysis data for use in reservoir calculations: (1) smoothing laboratory data, (2) correction of laboratory sample data for separator conditions, (3) determining total volume factors, and (4) correcting fluid-analysis data to reservoir bubble-point pressure.

Evaluation of field records for reservoir calculations calls for close examination of completion and workover records, production records, and well tests. Average fluid properties must be determined for fluids existing in both gaseous and liquid states.

The material balance. Topics on the derivation of the material-balance equation include (1) solution-gas drive, (2) solution-gas-cap drive, (3) simple solution-gas-cap-water-drive, (4) solution-gas-cap-water-drive with fluid injection, (5) slightly compressible hydrocarbon reservoirs, (6) gas reservoir, and (7) comparison of drives.

The 610-page book is published by McGraw-Hill Book Co., New York. It sells for $17.50. The book may be ordered through Reader Service Department, The Oil and Gas Journal, Box 1260, Tulsa 1, Okla.

INVERTEBRATE PALEONTOLOGY. By William H. Easton. Published by Harper & Bros., 49 East Thirty-third Street, New York 16. 701 pp. $10.

The renewed significance of paleontology as part of the modern earth scientist's broad education has resulted in this new book—for the professional geologist and for use in intermediate courses—stressing the functional approach to invertebrate paleontology.

Presented in customary systematic order, invertebrates are discussed biologically, for the reader with little or no biological training, giving only that morphological detail necessary for identifications.

For continuity of subject matter, the introductory treatment of basic concepts and conflicting theories in paleontology, biology, and zoology is closely connected to later discussions; animals are seen in relation to evolutionary progression, stratigraphic succession, morphological series, ontogenetic development, and adjustment to environmental or biological requirements.

ENGINEERING MANUAL. Prepared by a staff of specialists. Robert H. Perry, Editor-in-Chief. Published by McGraw-Hill Book Co., Inc., New York. $9.50. 641 pp.

This manual presents in individual sections the commonly used formulas, data, and methods in the principal engineering fields. Architectural, chemical, civil, electrical, mechanical, and nuclear engineering specialists have compiled for quick and easy reference that information most often required in the daily application of their profession.

Mathematics, mathematical tables, and physical and chemical data common to all engineering are brought together in the introductory sections. Tables, graphs, and other aids are presented with the appropriate engineering section.

The FOREMAN'S PAGE

PART 8—
FLUID FLOW

More questions and answers on fluid flow

IN A NORMAL situation, the heating oil from a distillation tower is stream-stripped in a side-stream stripper. Steam and oil vapors are returned to the tower through a vent-line. An instrument controls stripper level through use of a control valve as shown. A level alarm will indicate a high, or low, or normal level. A flowmeter indicates the rate of flow which during normal conditions is about 50%.

QUESTION 5a: In this situation what is the most probable cause of trouble?

- (a) No stock in tower.
- (b) OM&S tank valve shut.
- (c) Level-control instrument bad.
- (d) Cooler plugging.
- (e) Pump too small.
- (f) Flowmeter bad.
- (g) Pump lost suction.
- (h) Stripper vent line plugged.
- (i) One or more pressure gages no good.
- (j) Bypass open on control valve.

ANSWER 5a: Cooler plugging (d).

Liquid-level controller shows that stock is building up in tower. Flow rate is lower than normal. This is indicated both by the flowmeter and the small pressure drop across the control valve. Since the pump is operating normally, the cooler must be plugging.

QUESTION 5b: In this situation, what is the most probable cause of trouble?

- (a) No stock in tower.
- (b) OM&S tank valve shut.
- (c) Level-control instrument bad.
- (d) Cooler plugging.
- (e) Pump too small.
- (f) Flowmeter bad.
- (g) Pump lost suction.
- (h) Stripper vent line plugged.
- (i) One or more pressure gages no good.
- (j) Bypass open on control valve.

ANSWER 5b: Pump lost suction (g).

Liquid level in the tower is too high. A check of the flowmeter shows there is no flow through the discharge line. The flowmeter is not bad because zero pressure drop across the control valve also indicates there is no flow. Gage show that the pump is developing very little pressure. Therefore the pump must have lost suction.

QUESTION 5c: In this situation, what is the most probable cause of trouble?

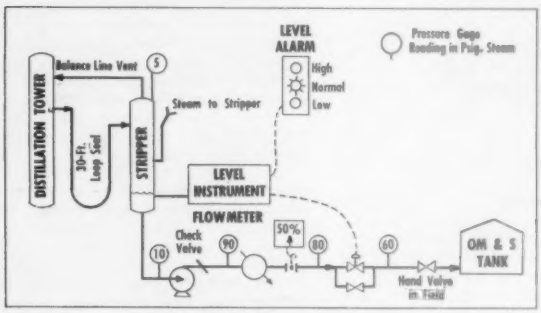
- (a) No stock in tower.
- (b) OM&S tank valve shut.
- (c) Level-control instrument bad.
- (d) Cooler plugging.
- (e) Pump too small.
- (f) Flowmeter bad.
- (g) Pump lost suction.
- (h) Stripper vent line plugged.
- (i) One or more pressure gages no good.
- (j) Bypass open on control valve.

Note: Flowmeter varying 0-90%. Pressure gages on pump discharge line to field vary erratically from those shown to 15 psig. Level alarm shows occasional normal level. All readings taken at one time while at 70% flow.

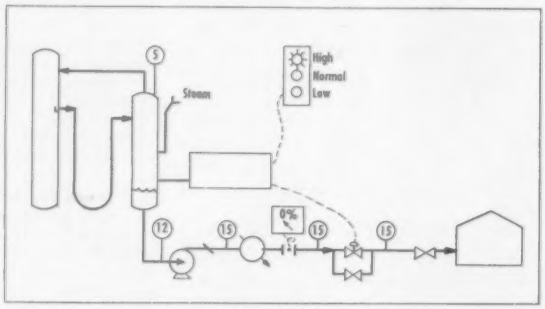
ANSWER 5c: Bypass open on control valve (c).

Wide variance in pump discharge pressure shows the pump is gaining and losing suction. Low pressure drop across control valve at high flow rate indicates that the bypass is open.

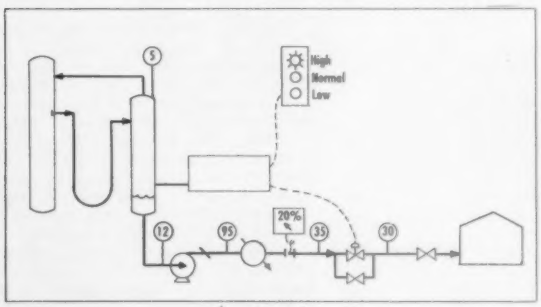
Part of the water in Tank 1 is to be gravitated into Tank 2. Tank 1 starts out with 50 ft. of water in it and Tank 2 is empty.



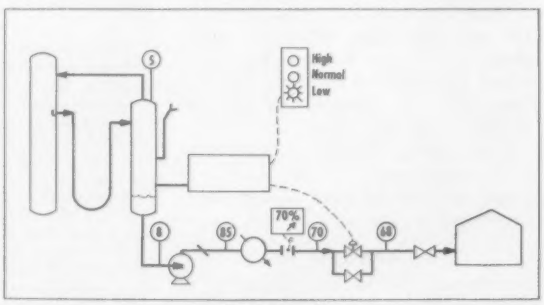
Normal situation.



Situation 5a.



Situation 5b.



Situation 5c.

There's no magic formula for spotting CREATIVITY

. . . not even those fancy tests devised by professional "head shrinkers" to aid the recruiter in surveying the annual crop of graduates. But there are ways to nurture the creative talent you have . . . of providing a favorable climate for creative effort.

BY JOHN M. CRAWFORD
Continental Oil Co.,
Ponca City, Okla.

CREATIVE PEOPLE come in all sizes, shapes, and colors. On casual examination, many of them are of ordinary appearance and action. A few are extraordinary in looks and manner—sometimes gaining the descriptive title of "odd ball," "egg head," or "spook." However, not all odd balls are creative. They may be merely handicapped by nature or what is worse, they may be putting on an act designed to confuse the unwary into believing that they are the "research type." A true aspect of effective management is early recognition and speedy elimination of this type, since they are a waste of money and frequently cause much internal trouble in the organization.

Many attempts have been made by professional and amateur "head shrinkers" to formulate rules and tests for selecting creative men from the herd. For the ultimate in procedures, a recruiter or personnel counselor would submit a series of questions or problems to the candidate. The score on this test would accurately rate the degree of creativity which could be expected on the job. However, none of these methods tried to date show a very striking ratio of success, and we are left to the same old procedure that has been in use for a long time.

If we want to hire from the current crop of graduates with the best chance of picking a winner, we hope for close acquaintance with a sharp faculty member, who'd be perfectly frank in his expressed opinion, who is interested in our field of science, and also in recognizing and developing originality in students. Using his guidance, a **scientifically** qualified recruiter can meet the student and discuss the type of problems to be solved, the facilities available, and the potential rewards for success.

The chances are that if the student is really a good prospect, he will be much interested in discussing details of problems to be solved, freedom to use originality and ways of familiarizing himself with background information, rather than listening to glowing accounts of retirement plans and vacations.

Try the work test. All of this increases the chances of selecting a creative man, but at this stage of the game, no one—not even the man himself—knows whether he will prove creative in this particular endeavor. The only sure method of finding out is to put him to work and see what happens.

It might be comforting to think that this is near the final decision. We now have our man. He proves to be creative or he doesn't. If he is, just sit back and let him create to his heart's content. If not, assign him to routine tasks or get rid of him.

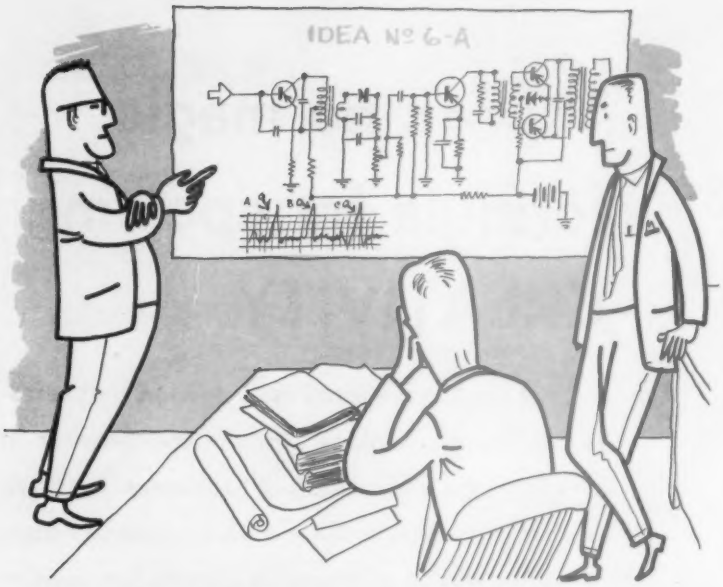
Nothing could be further from the truth. True creativity in action is not readily recognized nor is false creativity easily detected.

This false creativity can be carried on for a long time without anyone being the wiser. If the man knows the right words, the right idiosyncrasies, the general field of science, and is a good man with the old "snow job," his activity can pass as creative effort for a long time. At least, it can pass until someone realizes that nothing of value is coming forth.

This brings up another pitfall for those who select and evaluate creative people. It is most difficult to distinguish between the futile efforts of an unqualified man and the excellent work of a thoroughly capable man who is up against a problem for which no solution is possible at the time.

For instance, until recently the most skilled and energetic researchers in the business have been frustrated in predicting the response of the earth to a seismic signal. Detailed data on characteristics of the earth were not available in usable form, and computation of any except the absurdly simple cases quickly ran the hours of calculation beyond several lifetimes. Now, with continuous logs of velocity and other earth properties and with high-speed digital computers, actual sections involving hundreds of layers can be evaluated with a con-

The author is director, exploration research division, research and development, for Continental. He presented this article as an address before the annual international meeting of the Society of Exploration Geophysicists, at Los Angeles.



"It is mighty satisfying to watch a good group work. One man poses a problem, another has a vague, incomplete suggestion for a solution, still another has been reading in an unrelated field and remembers a mathematical concept which may be useful."

siderable degree of success, taking all primary and multiple events into consideration.

Because of advances in related fields of instrumentation, the problem which was impossible is now being solved. The men attempting the solution now are not more skilled or more creative than their predecessors; the world has changed. Thus, creativity can be measured only if the realm of possibility is pretty well known by those who measure.

Suppose we admit that we have hired a creative man. It remains to be seen what effect he will have on our organization and what effect the organization will have on the man. Ideally, both will become more creative than they were. This, also, is not automatic. It is possible, and it happens, that organizations containing truly creative people are not creative. On the other hand, if there are no creative people in the organization, it is very unlikely that any creativity will evolve. This runs counter to claims for "brainstorming" which will be considered later.

A perishable commodity. Once installed in or injected into an organization, creativity is a very perishable commodity. It needs to be recognized for what it is; it needs to be appreciated; and it needs to be rewarded. All of these—recognition, injection, appreciation, and reward—are functions and responsibilities of management; and here we include all levels of management. We might even go so far as to define management as including anyone who can win an argument by virtue of his position.

Some of the environmental features which encourage and promote creativity are:

1. The stimulation of work and workers.
2. Freedom from the foolish negative.
3. Adequate facilities.

Now, let's look at these features individually.

Stimulation of Work and Workers

There is nothing which calls forth originality like working with others who are tackling their problems with enthusiasm and coming up with worthwhile ideas, gadgets, and plans. There is a school of thought which contends that truly great discoveries are made by men working and thinking alone . . . that group creativity just doesn't work.

But the "lone wolf" doesn't really work alone. He has piled up a wealth of facts, ideas, and techniques from contact with others whether this contact be personal or through literature. If his background and help come from the literature, he may frequently be working with the best minds in the field, but he is working with knowledge dated at some time previous to publication. There may have been pertinent developments since that time which have direct bearing on the problem at hand.

On the other hand, a well-trained, creative colleague working on the team can instantly bring his most up-to-date knowledge to bear and usually this is done immediately without a time-consuming literature search in an unfamiliar field. In computing machine language, this might be called rapid access to storage. It is the lone wolf's privilege to take all these things into a corner and try to come up with something new and valuable, but this is the slow way to work at most exploration problems. In contrast to this, a group with a truly creative drive can pool their diverse knowledge and experience and make progress in hours, which may take the lone wolf days, months, or even years.

Watch a good group. It is mighty satisfying to watch a good group work. One man poses a problem, another has a vague, incomplete suggestion for a solution, still another has been reading in an unrelated field and remembers a mathematical concept which may be useful, and so it goes.

If the problem is a real tough one, members of the group will leave the meeting with the determination to look further into some portion of their field to bring more advanced knowledge to bear. At the next meeting of the group, there will be additional information presented and sooner or later the problem may take a beating. This is especially true in a complex science such as geophysics where advanced mathematics, physics, geology, electronics, mechanical engineering, and others must contribute to a successful solution.

This is **not** brainstorming; everything is done with a clear purpose. Ideas and suggestions get a good going over to see if they are applicable and sound, but the constant wish of the whole group must be to find a **better** way of doing everything—not just a way that is new and different. The first mental reaction which a new idea meets in a creative group should never be "That's obviously no good," but rather "Is there a possibility that there is something useful in that suggestion?"

Never steal. To be a member of such a group, a man must contribute freely and promptly and must feel so sure that he will receive credit for his contribution that he never worries about it. His ideas must never be stolen or ridiculed, but they must always stand the test of common sense and basic scientific principles. Any member of the group must expect to have his preconceived notions changed

"A truly creative man with a hot idea will not be willing to wait for the last word in equipment to be bought or built. He will round up whatever is available, use a lot of haywire, and make some measurements."

on the basis of scientific fact; and, if the boss wants to participate as a productive member, he must be quite willing to have his pet ideas refuted and to see better ones grow in the process of creative group thinking.

Freedom From the Foolish Negative

Creative ideas and plans are frequently slowed or annihilated by such remarks as "It just won't work"; "I don't like it"; "We do it differently"; "We tried it and it is no good"; or that prize excuse—"It's against our policy." Many times, the real meaning of such excuses is "I don't really understand it, so I am afraid of it"; or "We are comfortable the way we are, so don't rock the boat."

Adequate Facilities

The creative group's time can be sadly wasted by failing to provide good tools. This does not mean that everything must await the ultimate. A truly creative man with a hot idea will probably not be willing to wait for the last word in equipment to be bought or built. He will round up whatever is available, use sizable amounts of "haywire" and make some measurements.

Sometimes creative people have very little talent for or interest in perfecting things or reducing them to routine use, so the organization needs to provide those who systematize and perfect. It calls for real skill in management to have the proper balance between haywire artists and good design men. Too much haywire may mean that nothing is reduced to reliable practice while too much design may mean that nothing really new will evolve.

These are only a few of the obvious things at which management can work to promote creativity. The important thing is that management should desire creativity, recognize it, be willing to pay for it, and see that good use is made of any important product or process which results.

A busy word. This is a lot of discussion about a word. What is its significance in exploration today? We hear much about the dire straits in which explorationists find themselves when they look ahead. Costs are rising, rewards diminishing. Another way of saying the same thing is that unless we can do a better job of finding oil, we can't pay our way much longer. Let's take a look and see if creativity properly applied may change the picture.

Up to this time, the use of examples and general tone of discussion may be interpreted as restricting creativity to the research scientist. This is the most commonly discussed realm of creativity, but there is equal need for the creative attitude in all functions and at all levels.

For that matter, the realm of management fits part of Webster's definition for creativity exactly. **Creation** may refer to the production, forming, or bringing to pass, by influence over or stimulation of others, as to "create a favorable public opinion." If we bend the illustration slightly to say "create a favorable attitude in an organization," we have pretty well specified one of the highest attributes of management.

It seems that we should revise some of our thinking and rather than say "Management should encourage creativity," we should say "Management should **be** creative."

Many writers and speakers are currently discussing the problems and many good suggestions have been made which, if put to use, will improve the situation.

The purpose. The purpose and excuse for this article is to emphasize what seems to be a sound basis for building toward a very general solution. Let's call it an increased appreciation for and nurture of creativity. The essentials are proper attitude and sufficiently trained personnel. In our profession, the necessary training and brain power are available and, given the right distribution of the brain power and a good climate for creative effort, our problems can be solved.

". . . it is much easier to get management's approval for building and operating new gadgets than it is for hiring more interpreters and paying interpreters enough money to attract and keep those of superior ability."

Congrats and $25 to Mr. D. J. SUGGS, Republic Natural Gas Co., Tipton Bldg., Pauls Valley, Okla., for this quip.

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It has been said many times that in geophysical exploration, equipment development is ahead of interpretation methods and practices. Justification of this situation frequently brings out the corporate fact that it is much easier to get management's approval for building and operating new gadgets than it is for hiring more interpreters and paying interpreters enough money to attract and keep those of superior ability.

Let's come to the aid of the interpreters by pointing out some differences in the difficulty of s e l l i n g gadgets and interpretation. In the first place, gadgets can be exhibited and demonstrated to top management men. They may not understand the manner in which a particular one works, but they can see the size, complexity, quality of cabinet, and color of the final coat of paint and be amazed and gratified that their organization has labored and brought forth such a creation. What is even more important, most instruments can show a measure of success; that is, they can be demonstrated by laboratory tests as doing the job for which they were designed. At worst, a few days in the field will show that they perform as claimed.

Contrast this with the interpreter's handiwork. He labors over a stack of data, using much or little skill and effort and the evidence is a map or a cross-section. One may look just as good as the next. One may be an excellent and valuable interpretation and another may be worse than no map at all, if it is wrong. The decision as to which one is valuable must await evaluation by drilling; and the time which elapses between the interpretation and evaluation usually runs from 3 to 10 years. By that time, the interpreter is no longer an interpreter, and the details of how he actually made his interpretation are no longer remembered.

Turn him loose. Put the instrument designer on the same schedule and see how he might make out. Let him go ahead to design and build his new amplifier with the stipulation that the **only** test he can make is that it draws battery current. Then he must put it on the shelf for an average of 5 years before he can finally test and prove it. Would you like the job of selling to management the desirability of personnel and facilities for such a program? Yet this is essentially the problem of the man who seeks to staff up for a top job of interpretation.

It is the function of truly creative management to realize this discrepancy and act accordingly.

Group creativity can play a tremendously important part in one of the

most critical parts of any exploration program. This is the integration of all available information on a project, leading to a decision on whether to drill, farm out, hold, or abandon. This is a perfect setup for demonstrating group creativity as far as arriving at the best technical evaluation is concerned. Even if the final decision must be made by one man, he will, in most cases, be better informed if he has the results of a truly creative group effort at evaluation.

Here, again, the same rules apply to the group function as in solving a highly technical research problem in laboratory practice. Let's remind ourselves of some of the rules in light of this particular kind of group work. The words may be slightly different, but the meaning is the same.

1. The group needs experts in all fields—geology, geophysics, land, production, economics, etc.
2. Ideas, suggestions, criticisms, and questions must be given and received with complete freedom and sincerity.
3. Everyone must feel that he gets proper credit for his contribution.
4. There is no place for consideration of rank in the discussion. Rank takes its place in the final decision by necessity.
5. All data must stand on their own merits. No single variety of science needs an inside track because of glamor, antiquity, or position in management.
6. Positive thinking should be the most popular variety.

Apply creativity. The theme of our program is "Integrated Exploration," and its implications are truly important. This thesis is that integrated exploration will be best served and will be most effective if our problems are tackled cooperatively by creative people. It is up to management, at all levels, to see that creativity is applied.

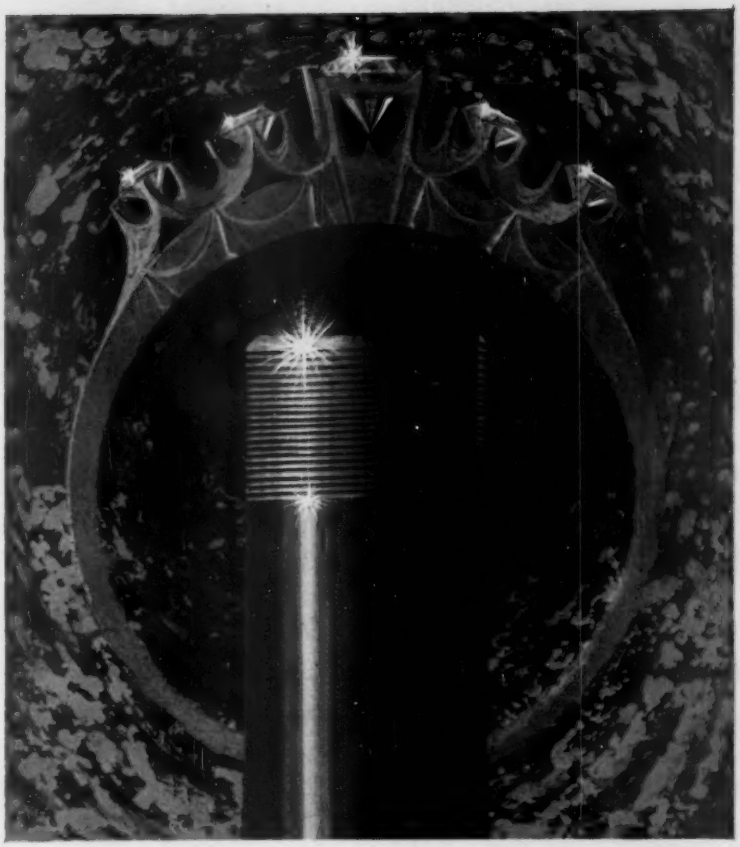
Starting Next Week:

New Series on Pumping Methods

JOSEPH ZABA, well-known authority on oil-well pumping methods, is the author of a new series of exclusive articles starting in The Oil and Gas Journal June 13.

Zaba, chief equipment engineering supervisor for Pan American Petroleum Corp., will discuss selection and use of both surface and subsurface pumping equipment.

Watch for this new weekly series, beginning next week.



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THIS STRANGE SIGHT welcomes visitors to Garland field in Wyoming. It may look like something from outer space, but it keeps the polished rods on dual pumpers in line. Several months of operation has shown that . . .

Ohio's "grasshopper" saves time, trouble, money

• Mechanical linkage on dual pumpers stops interference between rods and hangers. Modification described here can be installed in the field for about $150, which will pay out quickly in reduced maintenance costs.

BY W. B. BLEAKLEY
Production Editor

LEASES of Ohio Oil Co. around Garland, Wyo., have a new look these days.

Reason is the "grasshopper" type of pumping units on dually completed wells. Nine of these units are in operation, and more are planned.

The problem. On dual pumping wells, the rods and rod hangers of the two opposed pumping units operate with a minimum of clearance. Due to vibration and other causes, there is frequent interference between the equipment on one well and that on the opposed well. The result is wear of the touching parts, and sometimes one or more of the pieces are broken, or so badly damaged that replacement is necessary.

One way to overcome the problem is to use a "sled" or buffer plate between the hangers. But this presents another hazard. If the rod string fails near the surface so that slack is thrown into the hanger cables, the hanger can twist and hook up with the other unit. This usually results in an expensive overhaul job.

Ohio's solution. Fred Lindstrom, Ohio's foreman at Garland field, Wyoming, developed the grasshopper arrangement to get rid of the possibility of damage to the dual pumping units, and to cut down on service time.

Two members are required in the linkage between the walking beam and the rod hanger. The piece connected to the beam is 36 in. long and this length will take care of strokes up to 88 in. It is connected to the beam through a hinged bracket and bearing. The bearing for this swinging arm is made of a 1⅛-in. tube, 14 in. long, with a piece of 1⅛-in. cold-rolled steel as an axle.

The connecting links are made of 1-in. pipe. Automotive tie-rod ends, welded to the pipe, serve as bearings. Ears are welded to the rod hanger, and the tie rod ends are welded to these and to the swinging arm.

Advantages. This arrangement has proven satisfactory so far, and no trouble is expected. Specifically, these are some advantages of the system:

1. Most of the assembly work can be done in field shops out of readily available materials.
2. Cost for an average installation is only $150.
3. The time-consuming procedure of placing twist in the hanger cables each time the well is serviced is eliminated.
4. There are no disastrous results in the event of rod failure.

SWINGING ARM is connected to walking beam through a bracket welded on underside of beam. A 1⅛-in. cold-rolled steel "axle" through a 1⅜-in. tubular "bracket" acts as bearing. Location of 36-in.-long swinging arm from horsehead is found by trial and error.

LONG MEMBERS from swinging arm to rod hanger can be made of 1-in. pipe. Automobile tie-rod ends are used as bearings on each end of long members. Tie-rod ends are bolted through ears welded on rod hanger.

DorrClone Separators at Wilmington Field are equipped for manual dumping. Radioactive level-sensing device on side of sand pot shuts in well if sand level goes too high.

15 DORRCLONE SEPARATORS PROTECT PUMPING PLANTS FROM SAND IN WORLD'S LARGEST FLOODING OPERATION

■ California's Wilmington Field water flood operation, built and owned by the Long Beach Harbor Department, is being systematically carried out, fault block by fault block. Purpose is to increase oil recoveries, and to check land subsidence in the field.

At the heart of the system are completely automatic plants which take oxygen-free brine from nearby source wells, desand it, treat it and pump it into the oil bearing zones at 850-1250 psig.

DorrClone separators are operating on 15 wells in the field – removing 98% of all material with a specific gravity greater than 2.6. They keep mains and pumps sand-free for continuous operation at full capacity.

Feed water enters the upper chamber of the DorrClone unit tangentially creating a vortex action. Resulting centrifugal force throws the sand particles to the rubber coated walls of the cone where they pass downward to the underflow chamber. Sand-free water moves to the inner spiral of the vortex and is displaced upward and out into the mains.

The photograph demonstrates the simplicity of the installation. Units can be designed to suit practically all well water systems. For full information, write, Dorr-Oliver Incorporated, Stamford, Conn.

DorrClone – T.M. Reg. U.S. Pat. Off.

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WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

BY W. L. NELSON
Technical Editor and Petroleum Consultant

How much steam for vacuum distillation?

In your fourth edition of Petroleum Refinery Engineering, the amount of process steam used for vacuum distillation is stated as 0.3-1.0 lb. per gallon feed. Are there references which go into this more completely? J. W. H.

The amount of steam required in vacuum distillation is one of the most complicated functions encountered in process engineering, especially if the steam required in actuating the vacuum-producing steam jets is included.

The relationships are so complicated that simple summaries are nearly impossible. Thus, each plant must be investigated and designed so that a reasonably economical system can be adopted. Figures such as the 0.3-1.0 lb. per gallon are useful only as indicating the approximate range that has been found to be economical for some commercial operations.

The basic relationships for determining the amount of process steam required are outlined on pages 439-443 of the fourth edition of Petroleum Refinery Engineering (McGraw-Hill Book Co., Inc., N. Y., 1958) and exercise in the computation of partial pressure is available on pages 576-579. The lower the pressure the less the amount of process steam required (even to zero), but variations in the amount of steam required is enormous (see Process Costimating No. 33, OGJ, Dec. 1, 1958, p. 115). The variables which govern the amount of process steam required are primarily:

1. Pressure at vaporizer.
2. Amount vaporized.
3. Allowable maximum temperature.
4. Distillation curve of feed material.

Even if both the temperature and pressure are fixed, the relationship between the other variables is quite complicated (Process Costimating No. 31, OGJ, Nov. 10, 1958, p. 148).

Although less process steam is required if the pressure is low, exactly the opposite occurs with respect to jet steam, i.e. the lower the pressure the greater the jet steam requirement (Process Costimating No. 37, Jan. 12, 1959, p. 98). The temperature of the condensing water is the controlling factor, and for each pressure there is a limiting water temperature above which the steam requirement becomes infinitely large (Process Costimating No. 34, Dec. 8, 1958, p. 93). The optimum operating pressure which results when all of these variables are considered has not been discussed in the laterature except on the Questions on Technology page of The Oil and Gas Journal (Aug. 4, 1958).

From all of the above discussion, the need of detailed computations for each design problem is clearly evident. Although the general range of suitable pressures and temperatures can be obtained from the references, it is still necessary to compute several situations and then adopt intermediate conditions which will permit economical commercial operation.

More on size and cargoes of tankers

What is the cargo and dead-weight tonnage of a T-2 tanker? How can minimum cargoes be 20,000 bbl.? Can the T-2 tanker navigate the St. Lawrence Seaway when fully loaded? K.O.

Modifications have occurred in the design of the so-called T-2 tanker. It originally was a 16,000-d.w.-ton (long ton) vessel but some later vessels are rated at 16,700 d.w. tons and this is the size used in almost all recent literature. Responsible agencies, such as the Association of Ship Brokers and Agents (8-10 Bridge Street, New York) should be consulted for authentic information. Likewise, Seaway authorities must be consulted regarding allowable drafts through the Seaway.

Table 1 indicates the sizes of vessels, etc., used for various services. Barrels of capacity are stated in terms of material having a density of 30° API. For lighter materials (62° API) increase the vessel barrel capacity by 20% and the heavy materials (10° API) decrease the barrel capacity by 12½%.

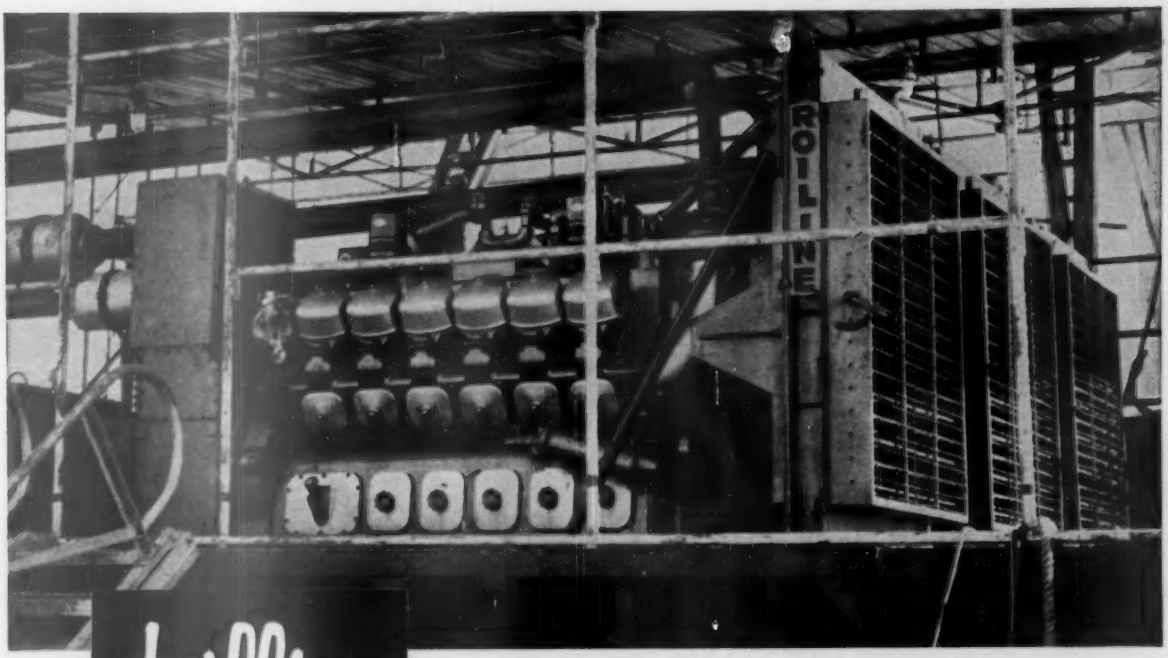
The article by H. N. Emerson entitled, "Oil—No. 1 Transportation Job," (OGJ, Nov. 18, 1957, p. 226) is excellent and it was used extensively in preparing Table 1.

Although minimum tenders of 20,000 bbl. are accepted for shipment, several such tenders must be available at the same time.

TABLE 1—REPRESENTATIVE DETAILS OF MARINE TRANSPORTATION EQUIPMENT

	Coastal service	To small markets or shallow ports	River tow, 10,000 tons	All-purpose tanker	American T-2 tanker	30,000-ton tanker	45,000-ton tanker	100,000-ton tanker
Dead-weight (long) tons	2,000	5,000—8,500	9,000	12,300	16,000	30,000	45,000	100,000
Oil capacity*	14,300	36,000—61,000	70,000	88,000	115,000	215,000	323,000	720,000
Length (between perpendiculars), ft.	245	335—400	.....	464	503	600	680	900
Breadth, ft.	39	48—56	.....	62	68	83	.....	130
Draft, ft.	16¼	22—25	.....	22.5	30	33.5	.....	.....
Speed, knots	10	11—11	.....	11.5	14.3	16.5	.....	.....
Manpower, men	.....	.....	28	.....	41	41	45	50
Power, installed horsepower	.....	.....	3,200	.....	6,600	13,500	17,000	27,000
Fuel, short tons/10^6 ton-miles†	17.1	13.8—8.1	17.3	6.5	15.3	12.2	10	7
Investment (1957), 10^6 dollars	.....	.....	1.7	.....	5.75	‡6.2	‡9.2	‡16
Investment (1957), $/d.w. ton	.....	.....	190	.....	360	‡206	‡204	‡160

*Barrels of 30° API material. A small amount of the capacity is needed for fuel oil. †Return in ballast. ‡Built in foreign yards. Cost is 40-50% more if built in American yards.



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Hydraulic "Zero lash" valve lifters eliminate tappet noise and adjustments and extend valve life. That means smooth, quiet engine operation and easier maintenance.

Exhaust manifold is water-cooled and integrally cast into the crankcase to provide cooler operating area and fast engine warm-up.

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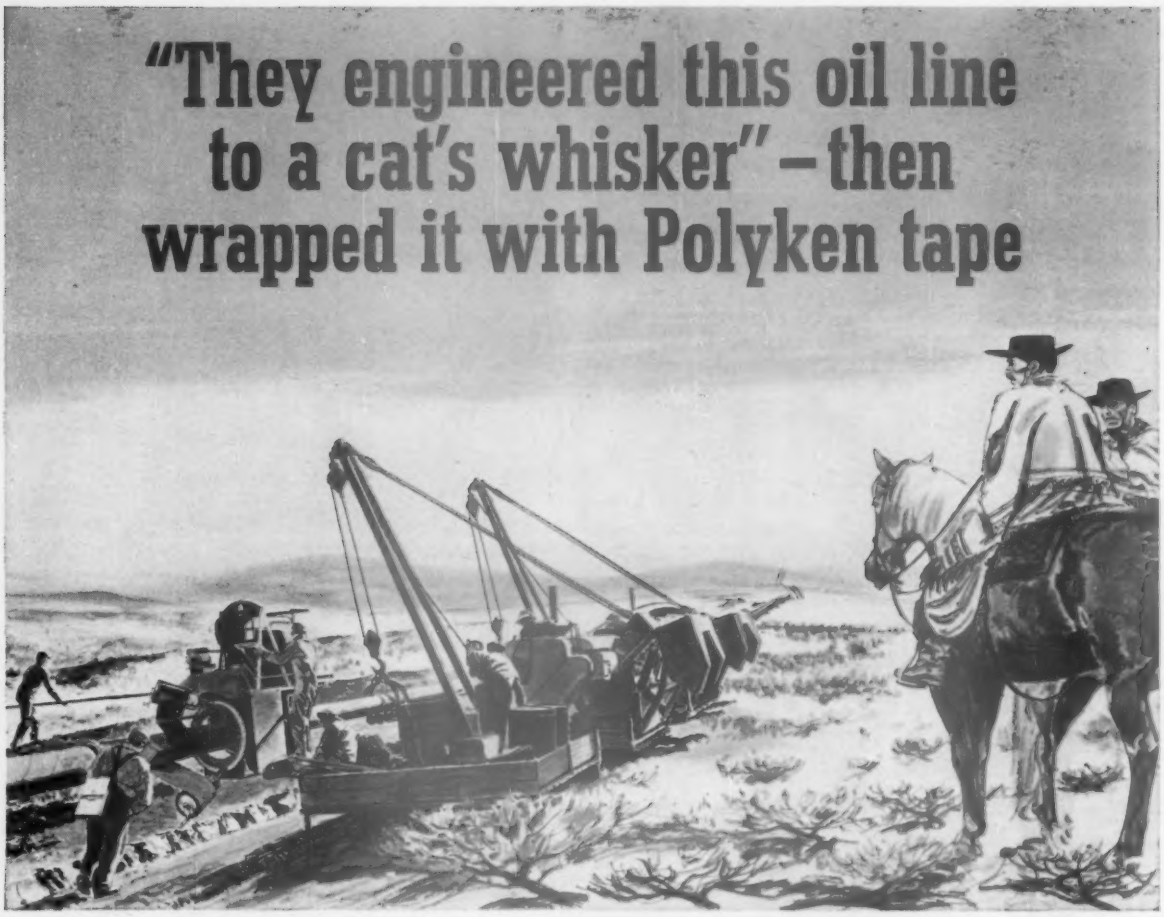
Model	Bore and Stroke	No. of Cyls.	Displ. Cu. In.	Max. Torque Lb./Ft. @ RPM	Brake Horsepower at Engine Speeds Indicated 600	800	1000	1200	1400	1600	1800	2000	2200	2400
H570	4⅜ x 4¼	8	570	490....1800		68	89	109	129	148	168	186	202	216
H884	5⅜ x 4⅜	8	884	720....1600		105	133	162	190	219	247	271	285	295
F1500	6⅜ x 7	6	1503	1170.... 600	134	176	214	230						
H2000	6¾ x 7	8	2004	1590.... 650	180	240	280	300						
L3000	6¾ x 7	12	3006	2420.... 650	275	360	435	460						
L3460	7¼ x 7	12	3468	2780.... 900	318	424	530	619	660 @ 1350 RPM					
L4000	7.54 x 7.5	12	4000	3280.... 800	385	500	615	706						

These are engine ratings on LP Gas . . . send for Power Chart with ratings for engines and complete power units operating on natural gas, LP Gas, and gasoline.

"They engineered this oil line to a cat's whisker"—then wrapped it with Polyken tape



One of the world's largest pipeline operators chooses the world's toughest tape coating for new Patagonian oil line

A leading international pipeline company recently wrapped over 100 miles of crude oil gathering and transmission line with Polyken No. 960 Extra-Strength Pipeline Roll.

The new line, which crosses part of the Patagonian plateau of southern Argentina, is an example of perfection in pipeline design. "They engineered it to a cat's whisker," is the way a seasoned pipeliner put it.

In their construction plans, the engineers specifically called for Polyken No. 960 Tape. Seven years of testing and study had convinced these people that Polyken delivers the durable, practical protection that a precision-built line needs.

There's a lot more to be said for Polyken tape. See your Polyken representative, or call the Polyken tape coating distributor nearest you. Or simply write Polyken, 309 West Jackson Blvd., Chicago 6, Ill.

Using tensioned-spindle equipment, pipe is cleaned and wrapped in one factory-smooth operation. Polyken tape is ready. No primer, no drying or cooling. No fumes or fire hazard.

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THE KENDALL COMPANY
Polyken Sales Division

In three steps, here's how one company went about . . .

Repairing line breaks at a river crossing

1. Burlap bags are filled with sand and cement to repair damage to a Susquehanna River crossing of Transcontinental Gas Pipe Line Corp. near York, Pa. Scouring action of the swift current had washed the river bed from beneath the pipe, leaving suspended spans at three points. Inspection by a diver determined the extent of the damage.

2. Sandbags are loaded on the barge, made by bolting together two pontoons, each 8 by 32 ft. A second barge, identical to this one, was anchored at the point from which bags would be dumped into the river.

3. Some 5,300 bags were dumped under the suspended spans, which if left uncorrected could have resulted in a break. The crossing was pinpointed by empty gallon tin cans. The repair job was photographed and reported by Bob Solomon, Transco Pipeline District 8.

For digging and filling pipeline trench

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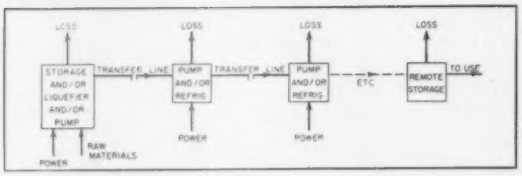
PIPELINING



SCHEMATIC shows how transfer system operates.

This system permits . . .

Transferring liquefied gases by pipeline

THE National Bureau of Standards' cryogenic engineering laboratory, in a recent study of liquefied-gas transportation, devised a mathematical model for pipeline transfer. This model attests to the feasibility of designing and using such a system for long-distance transfers in place of the Dewar method now in general use.

The current interest in liquefied gases, both in private industry and throughout government, has led the National Bureau of Standards to take a second look at accepted methods for long-distance transportation of these fluids. The results of a recent theoretical study indicate that the pipeline method, now used only in relatively short-distance transfers, can be extended to appreciable distances provided there is an awareness of the performance limitations introduced by undesirable cooldown characteristics.

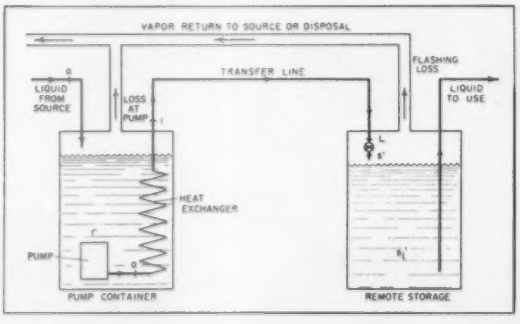
The design of such a system, which in many cases could undoubtedly increase efficiency, safety, and economy, is relatively straightforward. The Bureau's study, conducted by R. B. Jacobs of the cryogenic-engineering laboratory, Boulder, Colo., not only provides the theory for designing long-distance pipeline systems for low-temperature operation, but also gives information required for numerical computation.[1]

There are two categories of problems encountered in dealing with liquefied-gas transfers: those that are predominantly of an unsteady nature and that occur prior to the transfer system's cooled-down condition; and those that can be considered as steady state and are applicable only after the system has been cooled to operating conditions. Only the latter are considered here.

The bureau's study has a twofold purpose: first to discover what equipment and techniques are required for the long-distance transfer of the liquids and whether these are available, and second to determine what losses will occur during these long-distance transfers and whether they are tolerable.

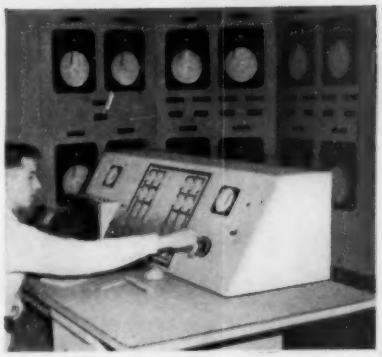
The primary component in the transfer's physical system is a length of insulated pipe—the transfer line. The state of the fluid is specified at both the inlet and outlet of this line. Either pumping systems or a process plant, such as a liquefier, can supply the energy required to force the fluid through the line. Pumping stations distributed along this transfer line may be more desirable than supplying all the necessary energy at the inlet. In this case, the system consists of a series of pipes with the fluid state specified at the inlet and outlet of each pipe.

Since it is wasteful to carry unavailable energy (as sensible heat) through the system, intermediate sta-



DETAILED components of a simple transfer system.

AUTOMATION ECONOMY



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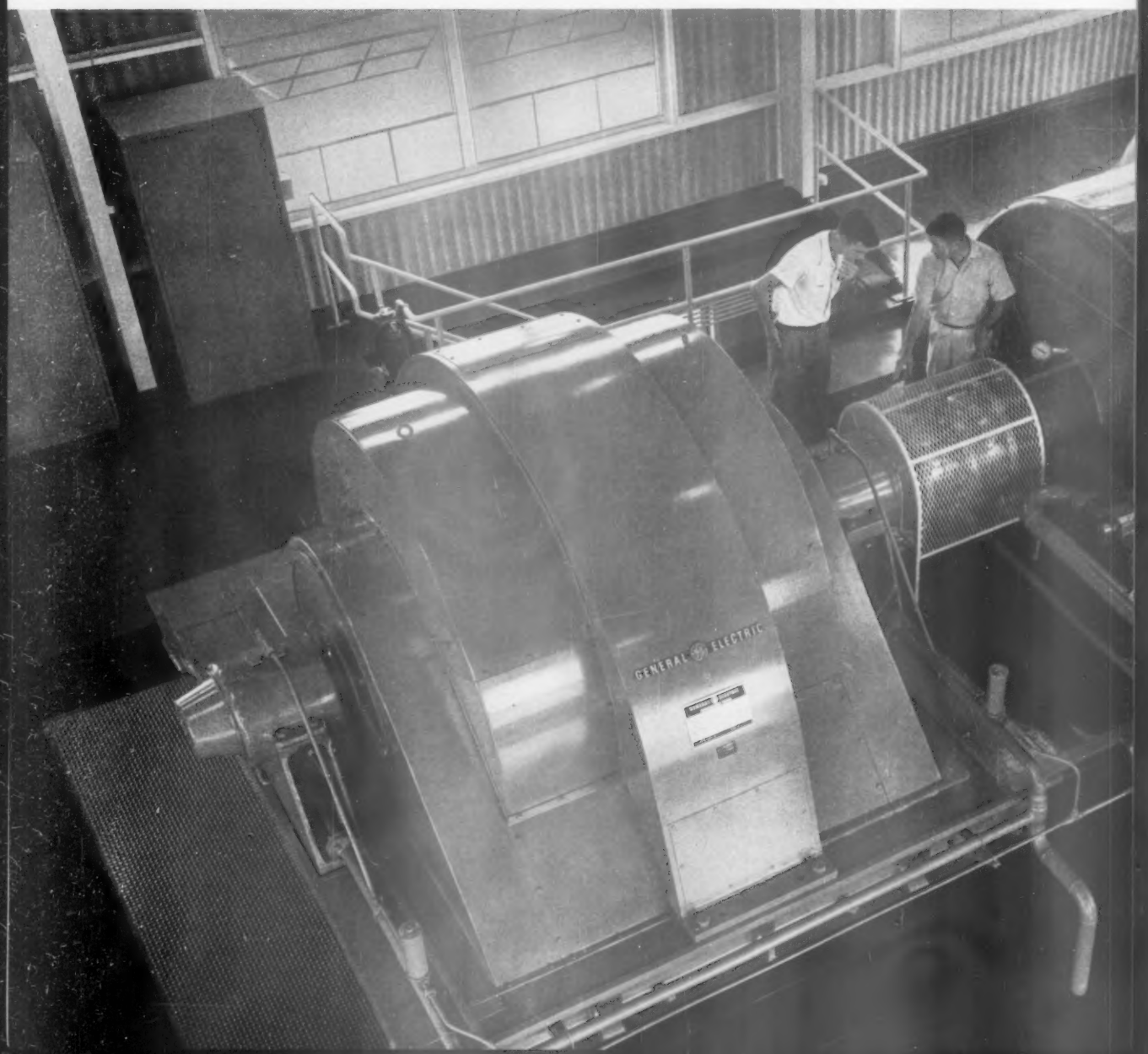
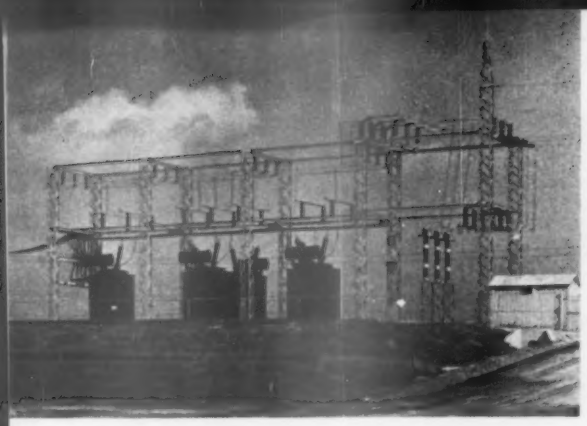
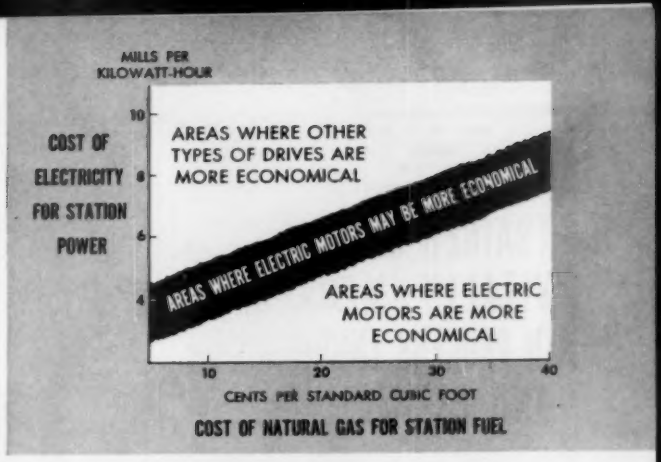
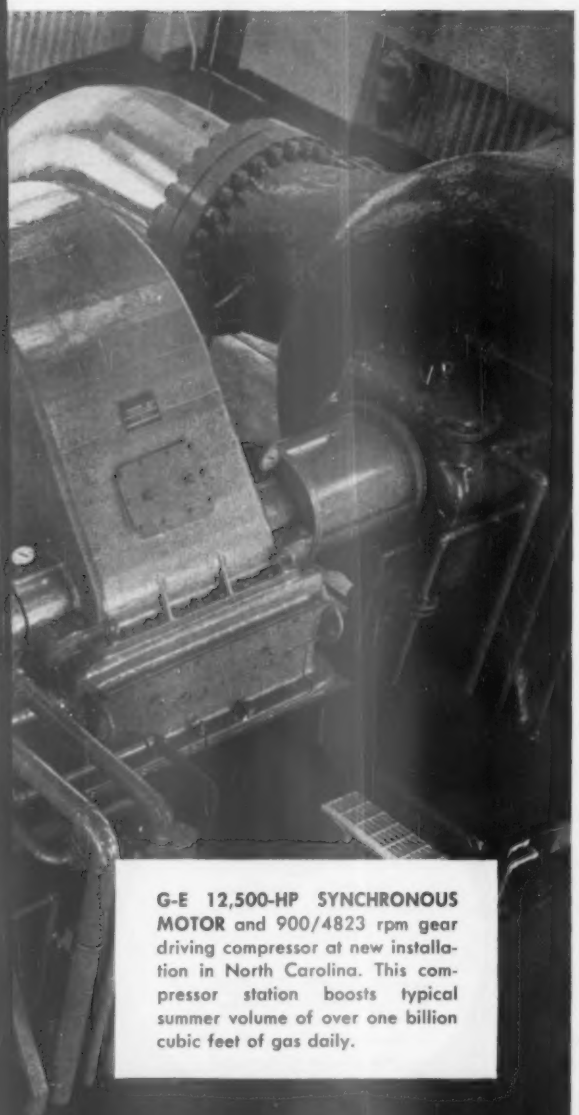






compressor drive... **CHECK LOCAL POWER COSTS**



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As the demand for natural gas increases, the use of electric power for driving pipeline compressors becomes more attractive. With low-cost electricity—readily available to pipeline companies in an increasing number of areas—General Electric high-speed synchronous motors give you these important advantages:

MAXIMUM RELIABILITY is inherent in the uncomplicated General Electric synchronous motor. Few moving parts, simple lubrication, and a pressurized air cooling system give you dependable, low-maintenance operation, day after day.

LOW INSTALLED COST is characteristic of compact General Electric motor drives. Initial cost of the G-E synchronous motor is significantly under that of other types of prime movers. And its installation—requiring much less space and foundation for its small size and weight—is simpler, faster, and less costly.

AUTOMATIC CONTROL of the compressor station is enhanced by the simplicity and ease of control of the G-E electric-motor drive. In addition, General Electric can co-ordinate the motor, gear, station control, and remote supervisory control for a completely integrated system which can be operated from miles away.

For information on how General Electric can help you analyze the economics of fuel/power costs in the locality of your next compressor station, call your General Electric Apparatus Sales Office or write to Section 661-01, General Electric Company, Schenectady 5, N. Y.

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TRAINED SPECIALISTS VITALLY IMPORTANT IN PROCESS ENGINEERING AND ESTIMATING . . .

The rapid, even meteoric development of the petro-chemical industry in the past decade has enhanced the role of importance played by engineering specialists with each step of its progress. Today, the engineer who is equipped with knowledge, study, training and experience in some specific phase of the processing cycle finds himself in an extremely favorable position and nowhere is this more obvious than in the realm of process engineering and estimating.

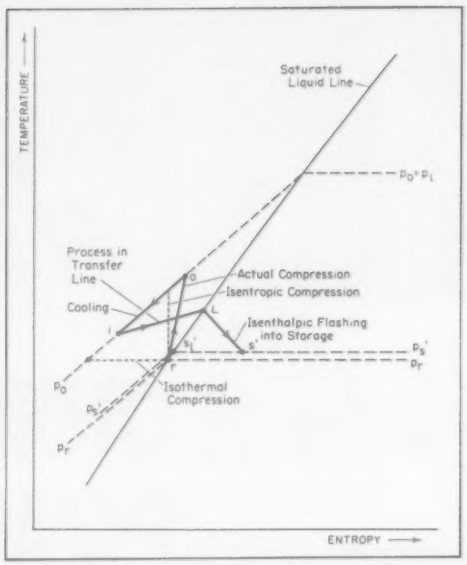
But industry has a new concept of a "specialist" in the complex of today's business society. He must have a broad concept of the total effort of his company, and cannot be content simply with "doing his job better than anyone else can." Since companies today, large or small, see their profits shrink as costs increase, the engineering specialist must apply his special knowledge or skill to the task at hand with diligence and genius, but with a practiced eye on the effect of his specialty on the profit structure of his company (or his client, or customer, if he is a consultant or supplier).

A generation ago, the "all-round" process engineer was himself a specialist, experimenting, researching, studying developing—combining "educated guessing" with engineering judgment to solve the problems presented. His was the task of dealing with all phases of an engineering process — design, estimating, operating — material and heat balances, temperatures, pressures, flow quantities, the design of special equipment, specification of instruments and controls, stress analysis, corrosion control, etc., etc.

Today, with larger, more complex plants — especially in continuous flow processes — and with greater expense involved in more complicated processes, many specialties have grown from the earlier process engineer specialist, resulting in accelerated advances in each specific field, as demands for more rapid progress are met. The petro-chemical industry in particular has demanded, attracted, developed — and paid for — men of unusual ability and broad vision, expert in their specific fields, communicative, articulate, aware and appreciative of the problems of other specialists as well as of business in general — and therefore more "profitably productive" for their companies. The search for these men increases with each new demand on the industry.

What training, background, experience is needed by today's process engineer to become a specialist? What is required in addition to an extraordinary interest and aptitude for a specific phase of engineering? There are certain technological requirements related to each field, of course, and they are fairly well-defined in each phase, but there are other more general, yet equally important, qualities and attributes on which the aspiring specialist must pass muster.

Space limitations in this column do not, of course, permit a full treatment of this important subject, but it has been covered more completely and in greater detail in a booklet entitled "Engineering Specialties: A Challenge," and complimentary copies are available to you by writing to: WESTERN SUPPLY COMPANY, HEAT EXCHANGER DIVISION, P. O. BOX 1888, TULSA, OKLA. — and remember, our engineers specialize in designing, estimating and building the heat exchangers in your future.



PROCESSES involved in a simple transfer.

tions along the line cool the liquid by one, or both, of two methods: refrigeration or flashing. If the liquid is flashed to atmospheric pressure, its vapor is discarded or piped back to a liquefier and the remaining liquid, which is at its normal boiling point, is pumped through the next section of pipe.

The bureau's conclusions are derived from a mathematical model based on the laws of conservation of energy, momentum, and mass. These laws were used along with verified assumptions and empirical data to yield a complete, unique model consisting of 12 equations which describe the flow characteristics of a transfer line. This flow model permits the design of a transfer system by relating all the pertinent design parameters: flow rate, line length, line diameter, pumping pressure, heat leak, and fluid properties.

Since the technical design of a system leaves economic and feasibility questions unanswered, the bureau undertook further studies based upon the loss of liquefied gas in the system. There are four ways in which losses occur: loss at the pump due to energy dissipation in the pump container and cooling before line entry; flashing loss caused by heat leak and energy introduced by the preceding pump; cool-down loss which occurs when the system is cooled from ambient to operating temperature; and trapped-liquid loss—from liquid that cannot be removed at the end of the transfer.

The bureau formulated relations from which each loss can be computed and expressed them in a form which facilitates the required computations.

In using the mathematical formulations to design a particular system, empirical information must also be used correctly. Equations for heat leak and fluid drag have therefore been included.

The bureau is now in the process of experimentally verifying its theoretical conclusions on long-distance transfer systems. In addition, the operating data on some large systems currently being built will be used in an effort to push the present results on a firmer basis.

References

1. NBS Circular 596 (December 1, 1958). Available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price 30 cents.

2. "Cryogenic Piping Systems Design Considerations," by R. B. Jacobs, Heating, Piping, & Air Conditioning, 32, 129, 1960.

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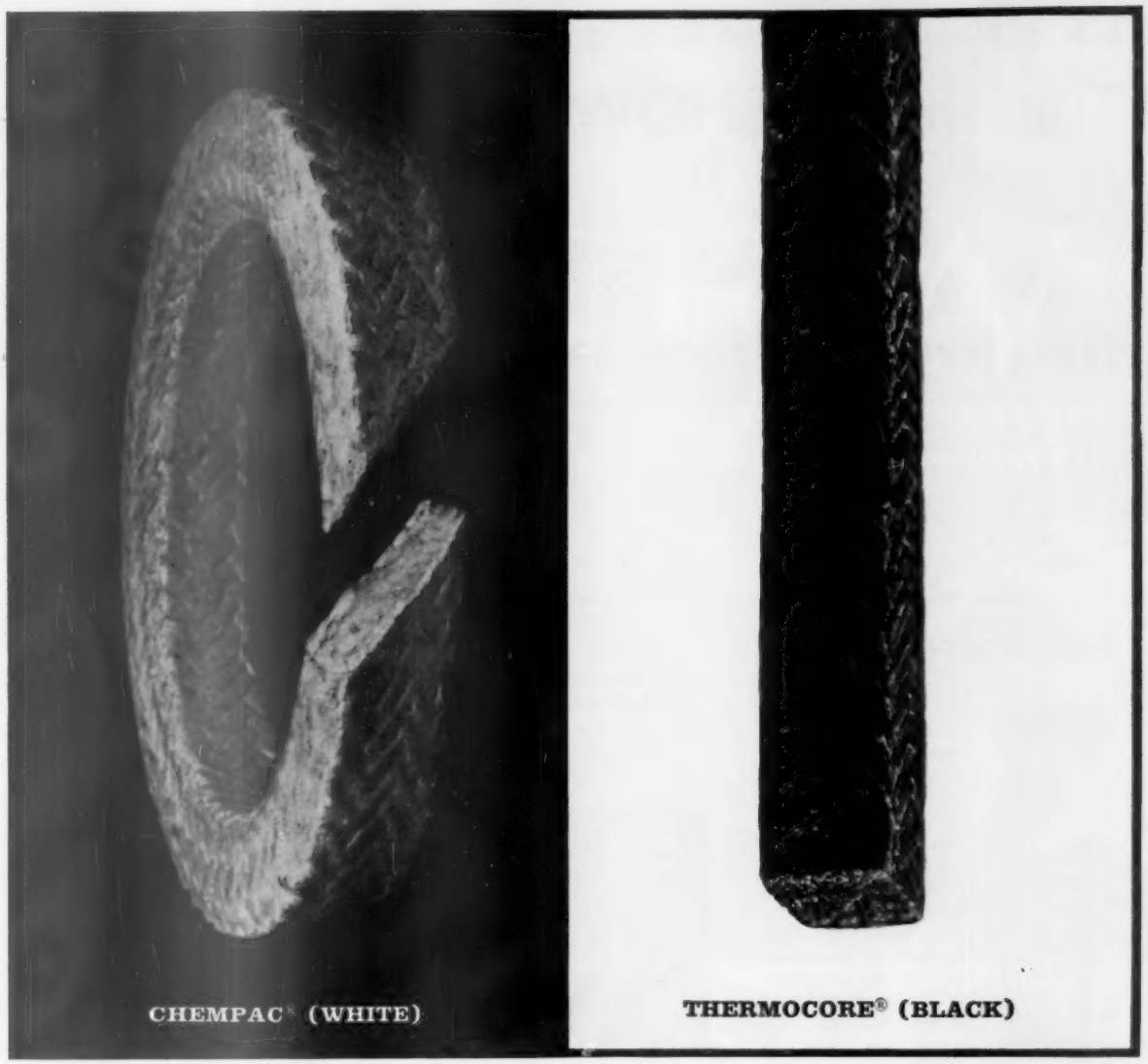

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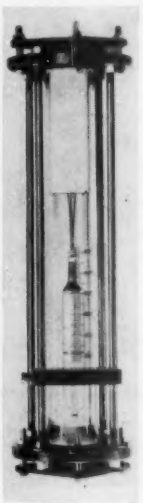
This week's SHOWCASE features . . .

New hydraulic dockboard

. . . can now speed loading and unloading of trucks and trailers, and offers a way to save labor time and storage space. The Aero-Board is a new kind of hydraulic dockboard that requires no electric power at the dockboard location. It uses air for power. Trailers or trucks can be backed into position with their doors closed. The dockboard measures 57 in. long and 60 in. wide. Made of welded construction, it is rated at 10,500 lb. wheel load or loaded 4,000-lb. capacity forklift truck. It comes as a kit ready to install. Source: **Freightliner Corp., Box 3591, Portland, Ore.**

Specific-gravity



. . . measuring device being offered is a nonelectric type for direct and continuous indication of the specific gravity of flowing process liquids. The density - sensing device is a totally submerged, chain-weighted Pyrex plummet. An antiparallax marker on the plummet of the Densitrol W-756 instrument is sighted through the external scale. A thumb - screw adjustment of the scale corrects for temperature-density effects. Any 0.05 or 0.10 specific-gravity span within the limits of 0.65 to 1.40 can be selected. A quick change of the same instrument to other process uses is possible by selection of stock components. Accuracy is ±1% of total scale. Source: **Precision Thermometer & Instrument Co., 1434 Brandywine, Philadelphia 30.**

●

Dynamometer

. . . handles many chores such as heavy-duty weight and tension measurement on cable-anchoring devices, for equalizing guy-wire tension, and for use as traction dynamometers. The Hydroway dynamometer is portable, compact, and accurate, the maker claims.

The maker's standard model is 13 in. long over-all, and weighs 15 lb. Capacity is 0 to 5,000 lb., with a built-in five-to-one safety factor. Under full load, maximum piston movement is 0.032 in. The 6-in. dial has black figures on a white face. Minimum dial graduation is 25 lb. Source: **Hydroway Scales, Inc., Box 531, Oakridge Station, Royal Oak, Mich.**

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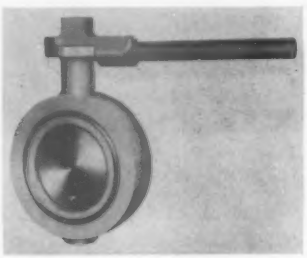

Aluminum valve

. . . just put on the market weighs only one-fourth to one-third that of ordinary valves and is recommended for use on trucks, trailers, fracturing units, and other installations where weight is a problem. The Buna N rubber lining is permanently bonded to the body of the valve to prevent buildup and to resist abrasion, a particularly valuable feature where corrosive or abrasive materials are handled. The quick-opening butterfly valve uses the resilient lining to give positive shutoff. Offered in sizes 2 through 6 in., the valve has a working pressure of 150 psi. Source: **Hale Mfg. Co., 2605 King, Tulsa.**

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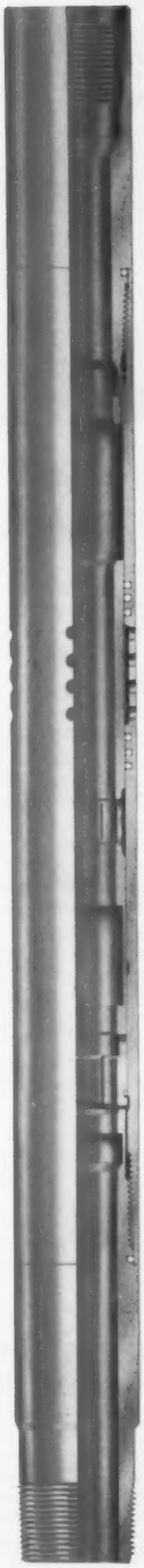

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GARRETT COLLET-TYPE SLEEVE WITH FULL CIRCULATING CAPACITY

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Wireline operated, Garrett circulating valves allow communication to be established or shut off in a tubing string. The proven Garrett internal sliding sleeve design is more dependable because the sleeve travels in a one-piece body. All sealing is on one plane, eliminating the possibility of pressure lock or pressure shifting. As a further safety feature all screwed joints have triple seals with tapered threads that insure positive locking.

Garrett circulating valves are available in 1¼", 1½", 2" and 2½" sizes and in all popular thread connections.

Check with your nearby Garrett field engineer for complete information and applications (he has information on those critical diameter parallel string dual completions, too). Call today.

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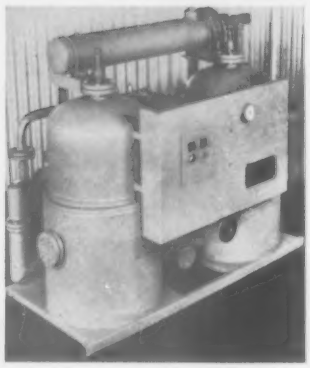

Gas dryer

. . . operates automatically while working on a 6-hour cycle. It adsorbs moisture, heats for regeneration, and cools with no more attention than occasional lubrication. It has adequate instrumentation that permits you to check operation at a glance, the maker says. Planned particularly for instrument-air service, the Type BZ Lectrodryer has few moving parts. These are easy to get to for maintenance. Source: **Pittsburgh Lectrodryer Div., McGraw-Edison Co., Thirty-second Street, Pittsburgh 30.**

●

New gasket

. . . for grooved couplings is available that protects bare ends of cement or plastic-lined pipe at joints. The Style E end-protection gasket is for use with the maker's standard Rigi-Grip coupling with tongue-and-groove interlocking mating faces. It is a single-piece, solid design with a compression sealing rib that fills the void between the bare pipe ends. The gasket and coupling handle pressures to 2,000 psi. and temperatures from —40° to 200° F. The gasket comes in sizes from 2 to 6 in. Source: **Gustin-Bacon Mfg. Co., 210 West Tenth, Kansas City, Mo.**

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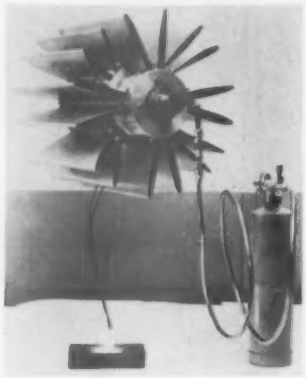


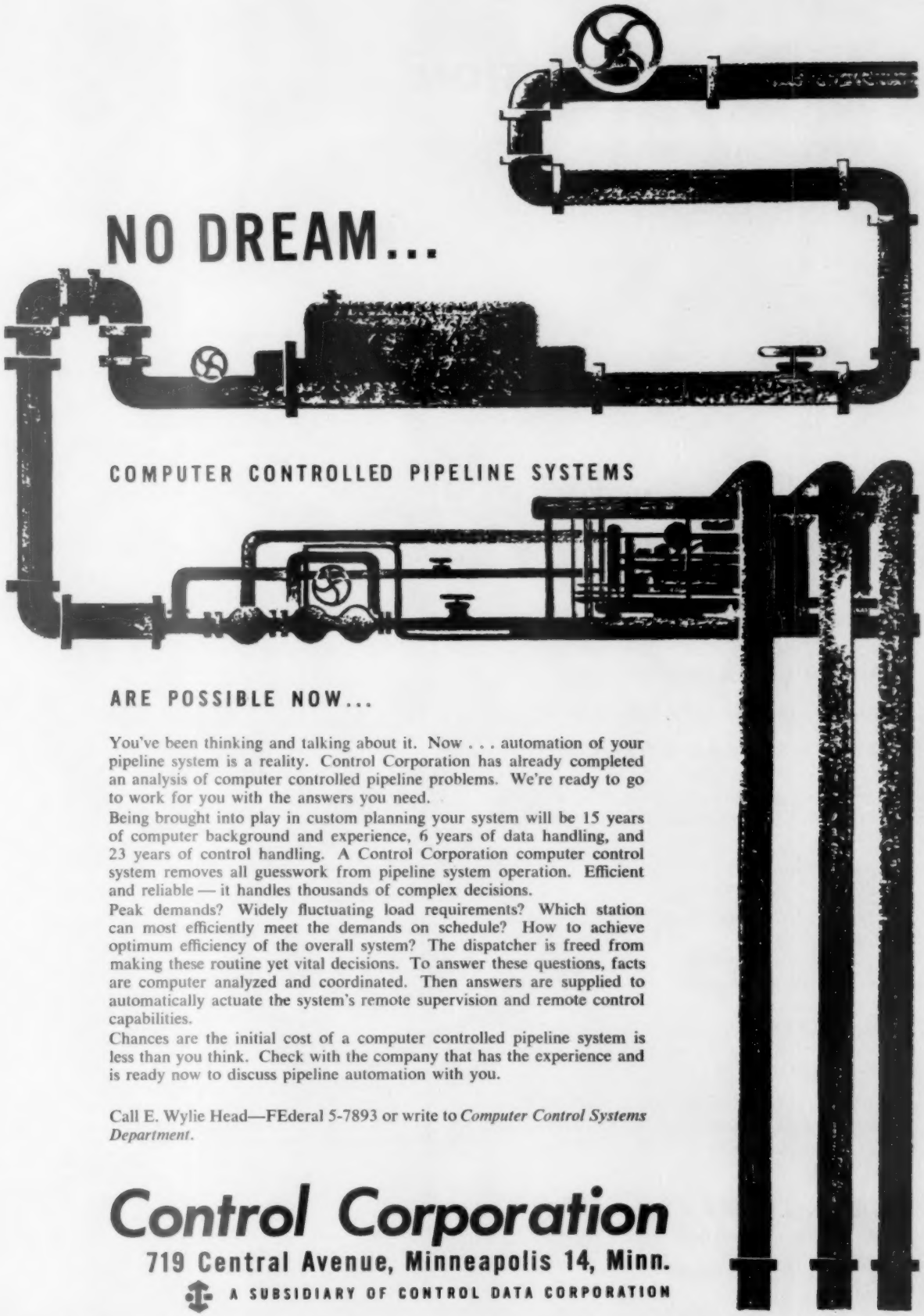
Thermoelectric

. . . generator available that produces 5 watts of power steadily and continuously for as long as the fuel supply lasts. The new generator is designed to run for about a year on a 200-lb. tank (50 gal.) of propane gas. The unit weighs only 10 lb., is 1 ft. high, and has no moving parts. The generator uses thermopiles of semiconductor elements to convert the heat of burning propane into electricity. According to the maker, the unit has at its center a burner that burns the propane gas at a constant temperature and uses more than 85% of the heat content of the fuel. Surrounding the burner is a metal combustion chamber. Attached to each of the four sides of the combustion chamber are the thermopiles. Heat not used by the thermopiles is conducted to heat-rejection fins made of aluminum, which form the outer shell of the unit and give it a starlike appearance. Source: **General Instrument Corp., 65 Gouverneur, Newark, N. J.**

Electronic data-processing system

. . . recently developed handles a wide range of petroleum data-processing needs, such as linear programing for refinery operations and well accounting. The RPC-9000 system is fully transistorized and provides automatic in-line records processing. Data is accepted in random order, and all affected records are automatically updated in one uninterrupted sequence.

The basic system includes a central processing and control unit which performs the calculations, controls the program, and searches the external memory tape; a continuous magnetic tape file for data storage; and an input-output typewriter system that reads the paper tape and punches tape. Source: **Royal McBee, Data Processing Div., Port Chester, N. Y.**



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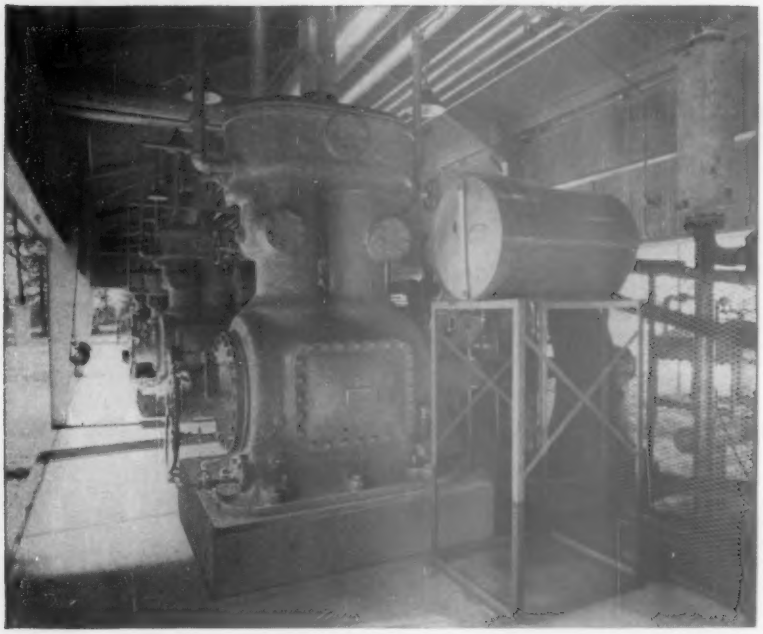

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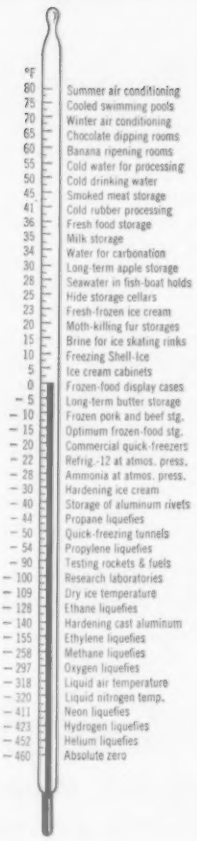
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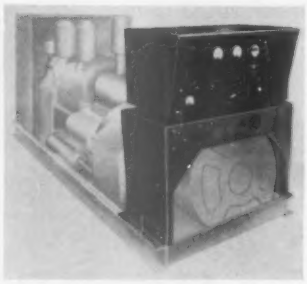
− 320 Liquid nitrogen temp.
− 411 Neon liquefies
− 423 Hydrogen liquefies
− 452 Helium liquefies
− 460 Absolute zero



Modular panel

. . . for engine-generators permits alterations any time and in only a few minutes. The Simplex modular system is designed so the top, end, and back of the panel can be removed quickly. Each module hinges forward for inspection without additional support. The hinged top makes the panel easy to get into for service. Source: **Simplex Co., 1139 North MacArthur Boulevard, Springfield, Ill.**

•

Cathodic protection

. . . is aided by this aerial-survey indicator. The maker claims it enables aircraft to monitor the condition of cathodic-protection stations in remote or isolated areas. It thus offers a way to eliminate the need for regular rounds by maintenance crews to check on the condition of stations. The indicator shows if the station is operating normally or if abnormal conditions exist, such as power failure to the rectifier, insufficient current level, or excessive current. It operates by monitoring the current to the pipeline being protected.

The two components of the indicator are a control box which does the monitoring or sensing and an indicator which gives the visual indication. The indicator comes in two models—Models 1P and 2P. Source: **Pipetron Co., 12926 Saticoy, North Hollywood, Calif.**

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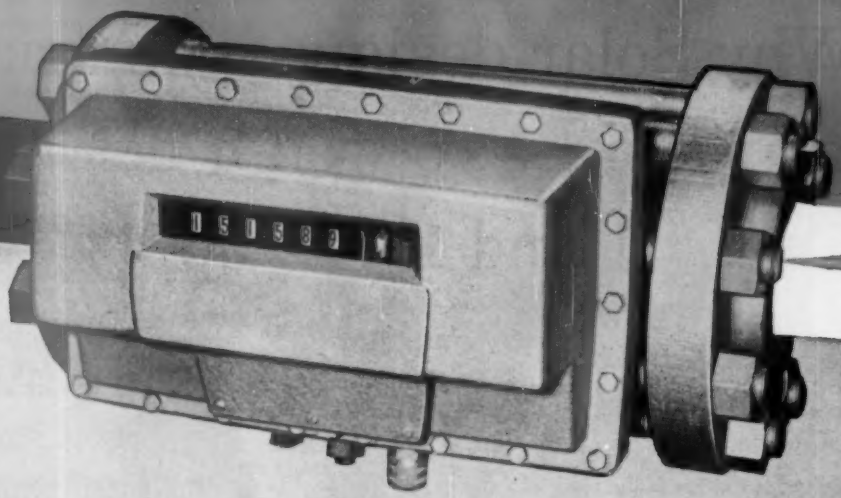

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The BS&B-GE Gyro-Integrating True Mass Flowmeter For Natural Gas*

Gives Accurate Gas Flow Measurement Under Wide Variation of Flow Rates, Pressures, Temperatures and Densities

You've read about the True Mass Flowmeter for natural gas. Now, you can put this accurate measuring device to work for you.

True Mass measurement eliminates the problems associated with varying gas densities, super-compressibilities and other physical properties. Measures directly and precisely the gas flow rate in pounds. Readily adapted to automation.

The BS&B Mass Flowmeter makes possible new economies at nearly every level of natural gas measurement. You get large savings not only from reduced calculating time but also from increased accuracy in gas accounting.

Gyro-integration in the meter eliminates chart handling and chart-integration by planimeter. The small, light, self-contained meter is ready for installation — no meter run is required. It's simple to operate and has long service life.

Get highest accuracy from this newest development in mass flow measurement. To prove this meter out for the natural gas industry, BS&B constructed a special prover facility which is believed to be the first positive prover for gases. For your specific application, write . . .

EFFICIENCY
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Mass Flowmeter Sales, Dept. 3-A6 P.O. Box 1714, Oklahoma City, Oklahoma

*Manufactured by General Electric
Calibration, Sales and Service by BS&B*

Why Solar designs industrial gas turbines to weigh between 1 and 1½ lb/hp

by Paul A. Pitt
Chief Engineer
Solar Aircraft Company

The weight of Solar gas turbines is the result of a design philosophy that is unique in the small gas turbine field.

Most gas turbine designs fall into one of two extreme categories. Aircraft-type engines, at one extreme, embody highly sophisticated techniques for extreme light weight in relation to horsepower, but have resulting short life. The opposite philosophy employs the ultra-massiveness of steam turbines to assure long life.

There are important disadvantages in both approaches when long life, reasonable cost, dependable operation, simple maintenance and easy transportation and installation are required. While aircraft-design engines (of ¼ to ½ hp/lb) can be modified and derated for longer service life, the resulting product is inherently delicate. This compromise inevitably results in short life.

Paul A. Pitt

On the other hand, massive design (of 10 lb/hp and up) leads to unnecessary structural bulk and introduces problems of thermal lag and distortion.

Since World War II, Solar has designed and built a variety of gas turbine units with characteristics that lead to both long life and low weight. The Saturn gas turbine engine, for example, is an 1100 hp unit intended specifically for industrial and military installations. It has a weight-to-power ratio of 1.1 to 1.4 lb/hp.

Although it is designed for long life, it utilizes only enough materials in its components to satisfy structural and thermal requirements. This approach resulted in a design that makes no compromises with durability and performance, yet meets the needs of industry for flexibility in a small package. It has an 1100 hp rating at a specific fuel consumption of 0.61 lb/hp-hr and a continuous rating of 1020 hp at 0.63 lb/hp-hr SFC.

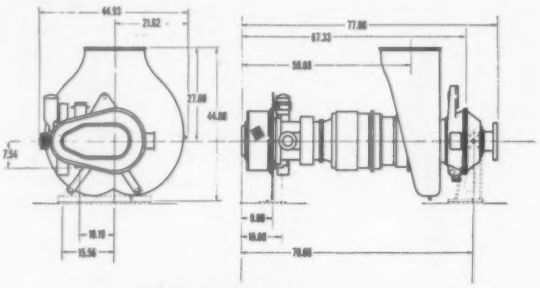
Meeting these objectives required an engine with a simple thermodynamic cycle and high efficiency components. An axial compressor was designed with an operating efficiency of 86%, and this was combined with a multi-stage, axial type turbine of advanced aerodynamic design. Over-all dimensions of the engine are shown in the figure below.

To fulfill workhorse service requirements, the engine was designed to operate at a conservative gas temperature of 1450 F continuous rating. The stress levels are also low, so that major rotating and stationary components will have more than 100,000 hours of life with long periods between overhaul. To keep costs down and assure dependability, the engine design is simple and straightforward.

In brief, the development program of the Saturn turbine adhered to three principles: Careful aerodynamic design for high performance; use of moderate temperatures and low stress levels for long life; and exhaustive component testing for ruggedness and reliability.

Presently scheduled field applications of the Saturn turbine include: Power source for 750 kw electric generator sets in process plants, portable field equipment, pipeline pumping, and gas compression in the petro-chemical industry. Other uses are as a power source for a 600 kw generator set in a commercial marine installation, propulsion units for marine and amphibious vehicles, and prime movers for off-highway vehicles.

Detailed data on Solar gas turbines and other turbomachinery is available. Write Dept. H-126, Solar Aircraft Company, San Diego 12, California.



Saturn T-1000 dimensions

SOLAR
AIRCRAFT COMPANY

Visible liquid-level

. . . gage is available for reading inventory and controlling batching amounts of liquid. Available on the maker's reinforced-plastic tanks, the tank-and-gage combination permits the liquid level to be clearly seen through the translucent tank wall and the volume to be read on the calibrated gage running the height of the tank. The gage offers a way to prevent overfillings due to faulty readings. Tanks with gages suitable for any liquid, including corrosives, are available. Source: **Jones & Hunt, Inc., Adelaide Road, Gloucester, Mass.**

●

Magnetic particle

. . . inspection made simpler as these inspection materials are now available in pressurized cans and plastic squeeze bottles. The materials can be used with any of the magnetic-particle inspection equipment or test kits already on the market. The new packaging technique permits tests to be made faster and easier when used in field testing and on parts of complex shape. The ready-to-use materials do away with bulky containers and the problems of mixing to a formula. The No. 14M fluorescent Magnaglo bath and No. 9BM Magnaflux bath are offered in 12-oz. pressure-spray cans. The No. 1 gray powder comes in plastic squeeze-bottle dispensers, each containing 1 lb. of magnetic particles. Source: **Magnaflux Corp., 7300 West Lawrence Avenue, Chicago 31.**

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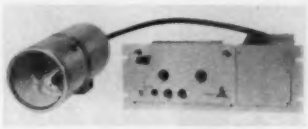

Industrial TV camera

. . . developed recently is built to withstand weather, shock, vibration, noise, salt spray, dust, and other extremes of environment without an auxiliary protective housing. The Dage Model RGS-10 television system consists of a camera and control capable of being operated up to 2,000 ft. apart. The camera weighs 15 lb., is 16 in. long, and 6⅞ in. high. The camera also weighs about 15 lb. and measures 7 by 19 in. The system is totally transistorized. Source: **Dage Television Div., Thompson Ramo Wooldridge, Inc., Michigan City, Ind.**

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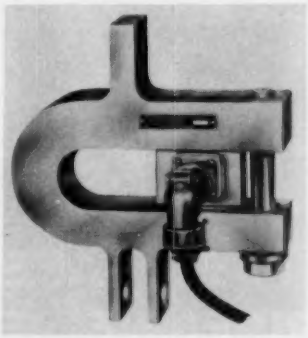


Force control switch

. . . for cranes and other equipment automatically triggers operations at various load points. It was developed for use on a clamshell bucket of a crane to activitate a series of lights indicating pickup load weight. The attachment eye and yoke are integrally machined as part of the deflection beam. As the U-shaped beam moves outward, switches in the housing at

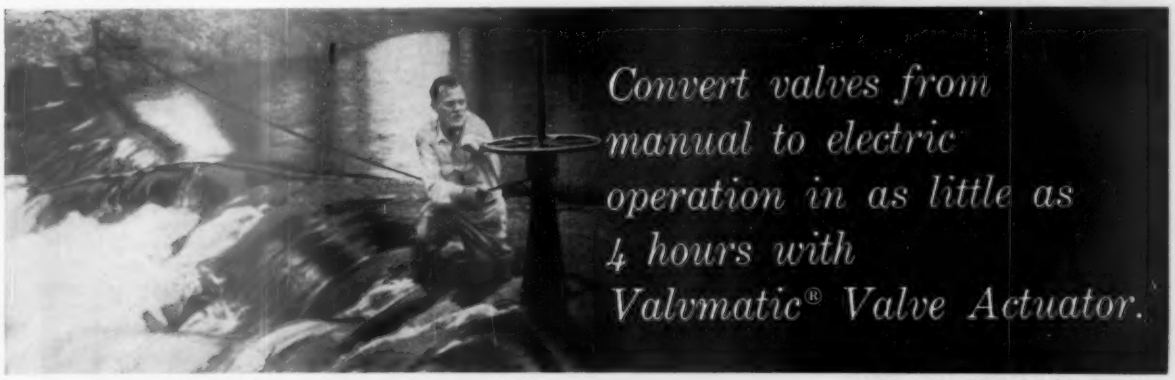


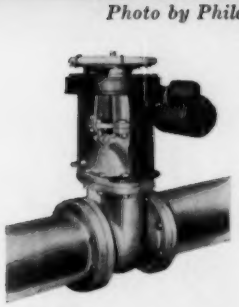
Photo by Philadelphia Inquirer

Now you can eliminate hand operation of hard-to-turn or remotely located valves with economical, easy-to-install Valvmatic.

- No special engineering or special tools
- No disturbance of piping or adjustment of valve
- No downtime of the system
- No replacing of existing valves
- No special wiring

Low initial cost. Minimum installation cost. Valvmatic converts either existing or new valves to push-button locally or remotely controlled operation. Suited also to automated or microwave applications.

High torque, instantly reversible motor, either totally enclosed or explosion-proof. Torque and position control for both directions of operation. If power fails, valve can be restored to manual operation in a few seconds. Performance tested by leading industries.



Write for Catalog V-200 today!

C. H. Wheeler Manufacturing Co.

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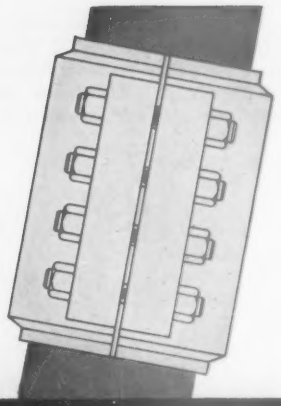
WV-148

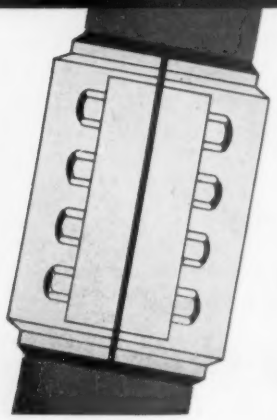


Completed Installation

FAST, SAFE PIPELINE REPAIRS WITH NEW SMITH SPLIT-COUPLING

The Smith Split-Coupling can be used as coupling, repair clamp or split sleeve.

Easy installation—Place halves around pipe. Tighten side bolts. **Permits welding while pumping.** Available in standard pipe sizes. Extra lengths and special dimensions on application.



Completed Installation (When welding is specified)

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Oil Properties

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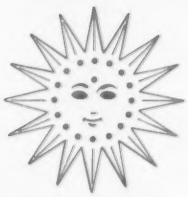

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the center are actuated at various preset load points by recessed adjustment screws in the lower half of the beam. The microswitches are enclosed in a dust and moistureproof case with an aircraft-type electric coupling. Load capacities from 5 to 50,000 lb. are available. Source: **W. C. Dillon & Co., Inc., 14620 Keswick, Van Nuys, Calif.**

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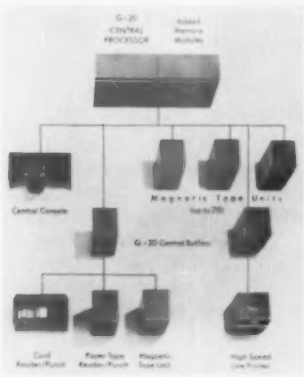

Electronic

. . . data-processing system now being produced is capable of 45,000 floating-point operations per second. The maker claims the G-20 system will offer versatility, expandability, and high computing power at relatively low cost. It has the ability to solve large scientific and data-processing problems at high speed, but with comparatively inexpensive equipment. The input-output equipment includes magnetic-tape units that read and write at 120,000 digits per second and 600 to 1,250 line-per-minute printers. The central processor is only 66 in. wide, 60 in. high, and 28 in. deep. Source: **Bendix Aviation Corp., 5630 Arbor Vitae, Los Angeles 45.**

●

New pH meter

. . . works fast to provide accurate measurement of acidity or alkalinity. The Model 72 meter is designed for rapid measurement of the pH of liquids, pastes, and semisolids. It measures over the full range from 0 to 14 pH, gives millivolt measurements from 0 to ±500 mv., and operates on 115-volt, 50-60 cycle power. The instrument has three conveniently located controls. Source: **Beckman Scientific and Process Instruments Div., 2500 Fullerton Road, Fullerton, Calif.**

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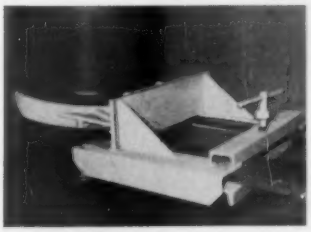

Drum arms

. . . enlarge lift-truck uses permitting a lift truck to handle steel drums quickly and safely. The Vert-O-Matic drum arms can be mounted on the forks or apron of any make or model lift truck. They automatically pick up drums in the vertical position, either one or two at a time. The maker claims they eliminate drum damage. Source: **Little Giant Products, Inc., 1593 Northeast Adams, Peoria, Ill.**

No-Wall-Stick Drill Collars

The surface area of these drill collars has been changed to reduce wall contact area by more than 40%. Weight loss of the drill collar is only about 4%. Reduction of 40% in contact area results in a proportionate decrease in the total sticking force due to differential pressure of 40%. This design also gives a section of pressure equalization each foot along the body of the drill collar.

Three sizes (6", 4¾", 4¼") of NO-WALL-STICK DRILL COLLARS are available on a rental basis in the Texas and Louisiana Gulf Coast area. Rental price of these NO-WALL-STICK DRILL COLLARS is very competitive to conventional drill collars run with stabilizers.

Any new or used drill collars, regardless of size, owned by Drilling Contractors or Oil Companies may be converted to NO-WALL-STICK DRILL COLLARS for a fixed conversion charge.

NO-WALL-STICK DRILL COLLARS offer far more protection from wall sticking in high angle holes or holes which have shale wash outs than drill collar strings using stabilizers.

NO-WALL-STICK DRILL COLLARS will not ball up, will not peel off wall cake, and may be sealed off by a Hydril type blow out preventor at any point.

Patent Pending

ENGINEERING ENTERPRISES
HOUSTON, TEXAS

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No-Wall-Stick Drill Collars
effectively reduce sticking of drill collars

This new drill collar design has been expressly developed to combat the problem of differential pressure sticking of the drill collar string in the hole. It is a direct step in materially reducing the total sticking force.
Please write Houston office for descriptive brochure and price schedules

No-Wall Stick Drill Collars may be handled through your local rental tool company.

For Constant, Uninterrupted POWER FLOW in the OIL FIELDS

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BALL BEARING MOTORS

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They are specifically designed to overcome the unusual conditions of Oil Field requirements, and there is a type and H.P. built to fit your exact needs. Unexcelled since they are . . .

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SEMI-ENCLOSED — normal or medium slip, 3 phase, 60 cycle. Has prelubricated ball bearings in semi-enclosed protected housing, 40 degree C rise. Built for continuous duty. High Torque, low starting current. Extra insulating coating throughout.

TOTALLY ENCLOSED — Fan cooled, normal or medium slip, 3 phase, 60 cycle. Has prelubricated ball bearings, totally enclosed FAN cooled 55 degrees C rise, for continuous duty. High Torque — low starting current. Extra insulating coating throughout.

Write for fully descriptive literature

BETHLEHEM STEEL CO. Supply Division **Tulsa, Oklahoma**

Manufactured by Valley Electric Corporation, St. Louis 8, Mo.

More Capacity per pump with VIKING'S new alloy PUMPS

STAINLESS STEEL • MONEL • . NICKEL • NI-RESIST • DUCTILE IRON • AND OTHERS

At new rated speeds, capacities are doubled in some cases, with the new line of Viking Heavy-Duty Rotary Pumps. On thin liquids, pumps are operated up to 100% rated speed. Resultant savings amount to as much as several hundred dollars.

These new rated speeds are possible because of our entirely new, modern electric foundry facilities and manufacturing processes. They enable us to meet more exacting requirements than ever before throughout the complete line of Viking alloy pumps.

If your specifications call for stainless steel or other alloy pumps, see how you, too, can save.

Write for Catalog MT

VIKING PUMP COMPANY

Cedar Falls, Iowa, U.S.A. • In Canada, it's "ROTO-KING" Pumps

Offices and Distributors In Principal Cities • See Your Classified Telephone Directory

SHOWCASE . . .

New Literature

Fluid meters

. . . Bulletin 20 outlines operation, ranges, and installation requirements of meters in eight pages. The bulletin also discusses integrators, compensators, and primary elements. Source: **Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10.**

Balanced-opposed

. . . air compressors for standard 110-psi. industrial applications are described and illustrated in newly released 12-page Bulletin 185. Included are photographs, engineering drawings, advantages, dimensions, specifications, and a special photo report. Source: **Clark Bros. Co., Olean, N. Y.**

Illuminators

. . . which are explosionproof for liquid-level gages are described in new two-page Data Sheet 375. It covers features and sizes of the instruments, which reportedly give a bright, evenly diffused light over the entire length of the gage glass. Source: **Jerguson Gage & Valve Co., 80 Adams Street, Burlington, Mass.**

Vapor fractometer

. . . called the Model 154-D, a new gas-chromatography instrument incorporating high-resolution Golay columns and highly sensitive detectors, is discussed in a new brochure just announced. The 36-page literature describes features of the instrument including columns, detectors, and sampling aids and accessories. Operation, construction, and specifications are also listed. Source: **Instrument Div., Perkin-Elmer Corp., Norwalk, Conn.**

Power inverter

. . . Folder M-110 promises to interest all users of microwave communications systems. The four-page folder describes how this transistorized 1 kva. unit converts battery power to a.c. power and supplies near instantaneous a.c. power to the load on interruption of commercial power. Optional equipment for either rack or wall-mounted models is listed along with a rundown of advanced features built into the unit. In addition, the new folder contains line diagrams showing how the Instapac power inverter can be hooked up to provide

IN A FIVE-MINUTE TELEPHONE CONVERSATION . . .

This gas processing specialist helped an operator save $3,000 a day

Recently, a West Texas natural gas processor called stating he was flaring sales gas due to high sulfur content caused by foaming in an ethanolamine system. The same antifoamants used successfully for some time were not effective. Subsequent questioning revealed that his gas stream was now at a higher temperature than the amine and a condensation of hydrocarbons resulted. On-the-phone-solution . . . raise the amine temperature to approximately 15° F. above that of the gas stream.

This, of course, was a simple one. More often Jefferson's experienced gas treating specialists will probe for pertinent data, request samples, and coordinate the solution of your problem through Jefferson's Austin Laboratories. Whether your problems be in desulfurization or dehydration . . . corrosion, foaming or contamination . . . Jefferson can draw on a vast fund of case experiences to help you avoid costly shutdowns, gas flaring or excessive solution losses.

For the *right* gas processing answers and chemicals . . . call Jefferson Chemical Company, Inc., 1121 Walker Avenue, P. O. Box 303, Houston 1, Texas.

Ethylene and Propylene Oxides, Glycols, Dichlorides, Carbonates
SURFONIC® Surface-Active Agents • Ethanolamines • Morpholine
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split-second power in conjunction with (or even without) an emergency engine-generator power source. Source: **D. W. Onan & Sons, Inc., 3628 University Avenue, S.E., Minneapolis 14.**

Achievement report

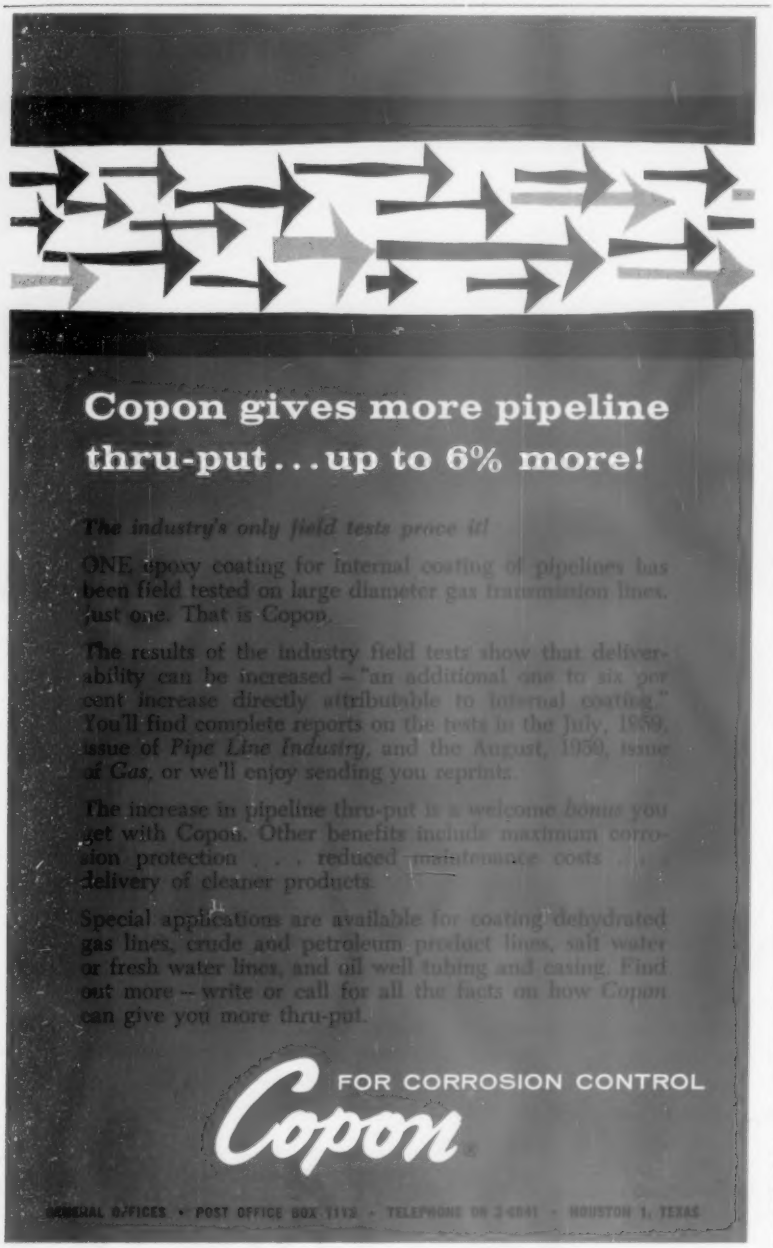
. . . of Sam Carline, Inc., (in brochure form) features on-the-job photographs of pipeline and other projects which the firm has completed. The publication also describes Carline's operation, equipment, and personnel. Source: **Sam Carline, Inc., Berwick, La.**

API publications

. . . for oil marketers are listed in a new catalog now obtainable free upon request. The catalog contains the names of 62 publications, a brief description of each, and its cost. Source: **Marketing Div., API, 1271 Avenue of the Americas, New York 20.**

Heat-resistant cast

. . . high alloys guide contains a comprehensive article on factors involved in selecting high-alloy heat-resistant castings for applications where temperatures exceed 1,200° F. The article separates 14 cast grades available for high-temperature service into three distinct groups, according to their chromium and nickel content. This division of grades makes it convenient to indicate which group of alloys is most applicable for any specific high-temperature environment, and also the degree of preference within each group. Source: **Alloy Casting Institute, 1001 Franklin Avenue, Garden City, N. Y.**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Jet-driven gas turbine

. . . is described in new eight-page Brochure 95, which gives the concept and operating characteristics of the 10,500-hp., RT-248 turbine. The publication reviews the development of this new power concept, and discusses thermal efficiencies, maintenance costs, and potential applications. Included are three pages of schematic drawings, performance curves, and engineering data. Source: **Cooper-Bessemer Corp., Mount Vernon, Ohio.**

High-speed process chromatograph

. . . along with the use of chromatography for closed-loop process control are subjects of a set of illustrated four-page brochures now being offered. According to Bulletins 1859 and 1860, the Type 26-212 chromatograph features modular design for flexibility, and automatic programing of up to eight streams. The instrument, coupled with pneumatic controls, is designed to analyze product streams and take corrective action. Included are diagrams, photos, and specifications. Source: **Consolidated Electrodynamics Corp., 360 Sierra Madre Villa, Pasadena, Calif.**

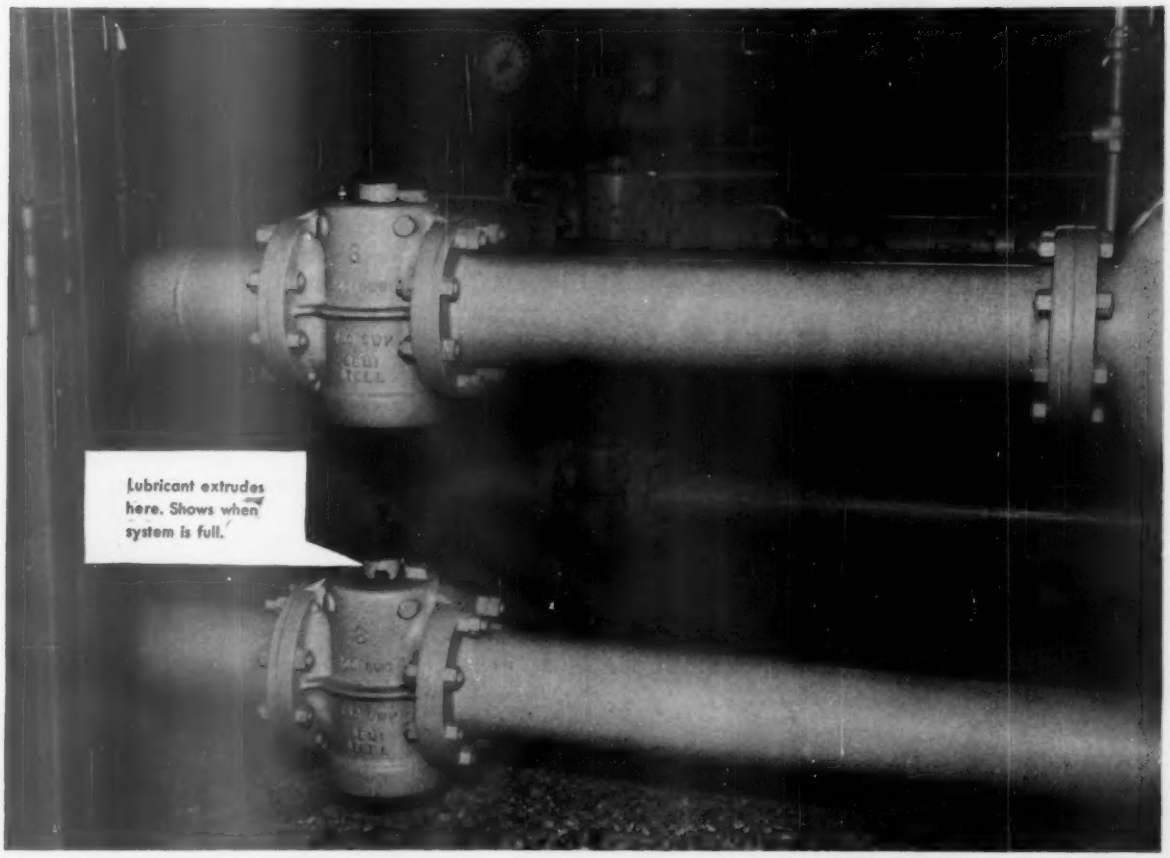
Pipe unions

. . . and check valves are featured in newly published Catalog 60, yours for the asking. The 20-page publication is packed with illustrations, materials, methods, construction features, specifications, dimensions, and pictures. Source: **Catawissa Valve & Fitting Co., Catawissa, Pa.**

Normalized fittings

. . . for pipe are spotlighted in a new four-page bulletin which outlines a test report made by United States Testing Co. Objective of the tests was to demonstrate superior ductile qualities of swaged nipples made from A-106 Grade B pipe versus swaged

YOU GET DEPENDABLE VALVE SERVICE from HOMESTEAD® Lubricated Plug Valves. Their controlled high-pressure lubricant system (plus very close tolerance between plug and body) guarantee



positive shut-off without extrusion of lubricant into the line where it might clog orifices, meters or low-pressure lines. Instant operation is assured, too, because sticking is prevented by piston-like movement of the plug during lubrication. And to make sure that all the benefits are in *every* Homestead Lubricated Plug Valve, *each one is tested before and after lubrication.* For full information, send coupon.

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DOWELL CUSTOMER GETS

"NEW" WELL FOR PRICE OF FRAC JOB

Engineered fracturing—as practiced by Dowell—can do many things for producers. Treatments can increase production, reduce workover and production costs, improve gas/oil or water/oil ratios, and increase recoverable reserves. Fracturing has even saved valuable wells from abandonment.

A Texas Panhandle producer feels like he got a "new" well for the price of a frac job . . . here's how it happened:

Production had declined to 11 bopd—pumping—from an old well completed into the Cleveland sand. Completion was through perforations from 6420 to 6458 feet. Workover was considered because new offset wells tested 400 bopd on completion.

Dowell engineered a fracturing treatment with the "Frac Guide"*. Waterfrac was selected for efficiency and low cost. 40,000 gallons gelled water and 105,000 pounds sand were used. 70 gallons of Freflo* were used to prevent emulsions, and 100 ball sealers were used to divert part of the treatment into less permeable zones. Injection rate was 65 bpm at 900 to 1400 psi down seven-inch casing.

Following treatment, *production stabilized at 105 bopd flowing.* Payout time for fracture treatment was four months.

DOWELL FRACTURING AND ABRASIJET HELP GET GOOD PRODUCTION FROM "PROBLEM" FIELD

Wells in the Langlie Mattix field of Lea County, New Mexico, are hard to produce. The oil pay of the Seven Rivers formation is tightly sandwiched between water below and gas above. It will not produce satisfactorily without stimulation—yet fracturing usually results in water or gas rather than oil.

Dowell engineers suggested a two-stage treatment that is working extremely well. First, Abrasijet* is used. The jetting tool is set in the middle of the oil zone at about 3585 feet, and the walls of the open hole are jetted with oil and sand. This produces considerable enlargement of the well bore.

Then wells are fractured, using 10,000 gallons lease crude and 10,000 pounds sand. This relatively small treatment is designed to provide the needed stimulation without breaking through to either gas or water.

Success has been outstanding. *The first fifteen wells treated are all producing their allowables; only two are producing appreciable water and none have broken through to gas.*

OPERATOR USES DOWELL FRACTURING TO STRETCH OUT DECLINE CURVE

Wells completed in the 'D' sand of the Southwestern Wayne pool in McClain County, Oklahoma, had not responded well to fracturing. Usual treatments had been 10,000 to 20,000 gallons of refined oil carrying one pound of sand per gallon. Initial production would be satisfactory but production would decline rapidly—frequently approaching pre-treatment levels in less than a month.

Dowell engineered a treatment with the "Frac Guide". Petrojel* was recommended for a well completed through perforations from 6977 to 6994 and from 7062 to 7076 feet. 20,000 gallons gelled crude with F.L.A.* (Fluid Loss Additive) and 46,000 pounds sand were used. 25 ball sealers were injected at mid-treatment. Injection rate was 21 bpm. *Before treatment, production was 10 bopd. Three months later, production had STABILIZED at 30 bopd.*

GOOD GAS/OIL RATIO RESULTS WHEN KANSAS OPERATOR USES DOWELL FRACTURING AND ABRASIJET

Wells completed into the Mississippi Chat of the Spivey-Grabs pool in Harper County, Kansas, have a GOR limit of 3000/1. An operator wanted to fracture to improve production—yet not break through to gas. Abrasijet was used to perforate casing at 4464 feet. Then, following treatment with 500 gallons Mud Acid, well swabbed 12 barrels of oil in seven hours.

After fracturing with water and 3500 pounds sand the well *flowed* 10 boph on a ¼"-choke. *Gas/oil ratio was only 1323/1—exceptionally good for the field.*

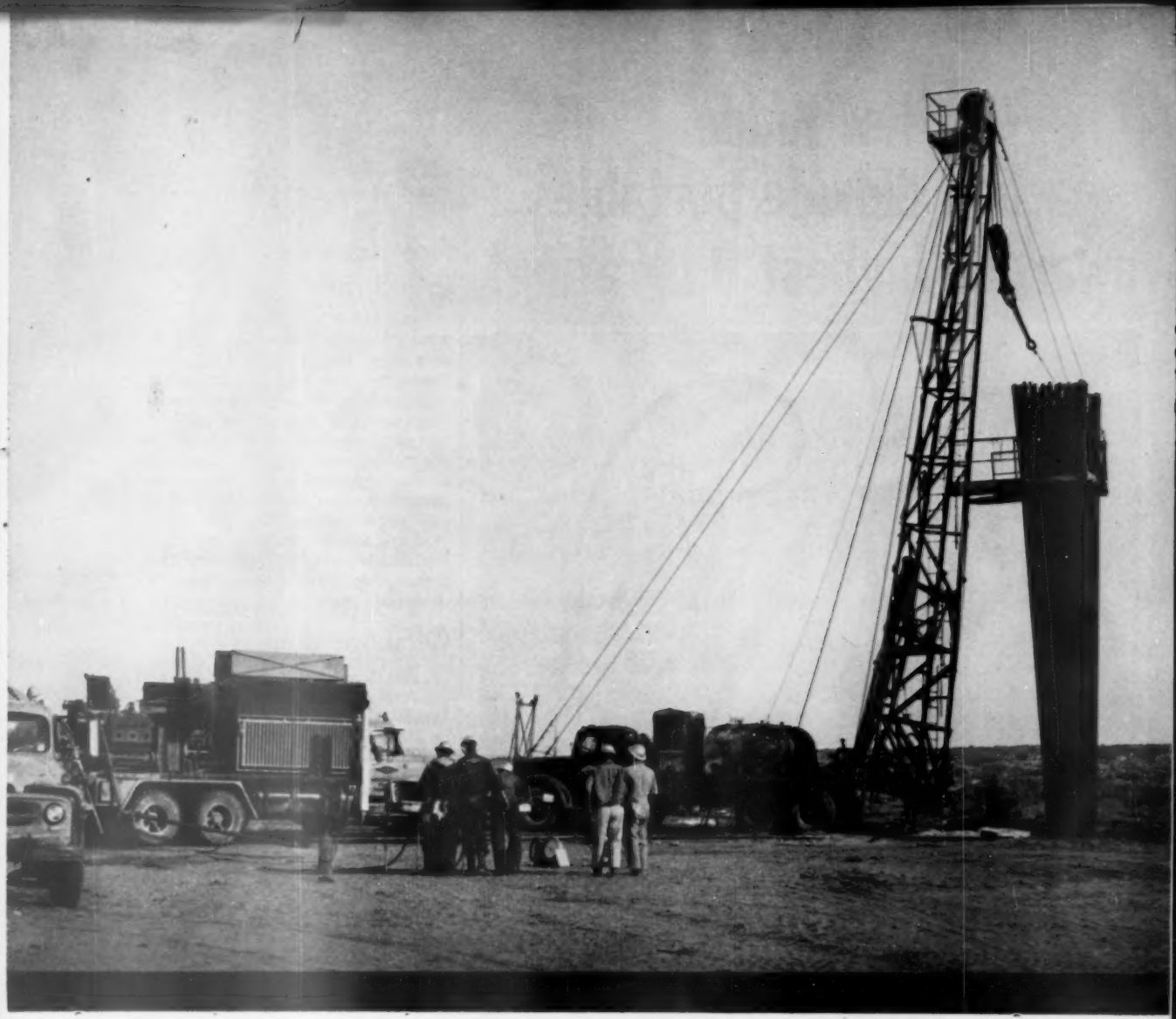
Your Dowell engineer can help you select a treatment to solve your well problem. Call him for further information or service. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Argentina, and Venezuela. Dowell, Tulsa 1, Oklahoma.

*Dowell Trademark

Services for the oil industry

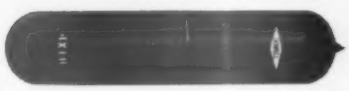
DOWELL

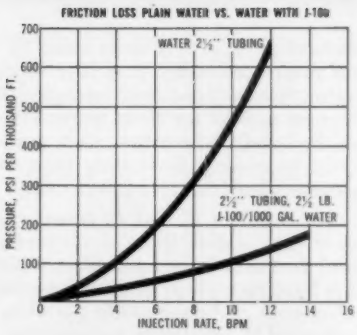
DIVISION OF THE DOW CHEMICAL COMPANY



NEW IDEAS FROM DOWELL

TO HELP YOU MAKE MORE PROFIT





ROCKSHOCK*

This new Dowell service employs glass *implosion* capsules to clean formations or reduce breakdown pressures ahead of fracturing or acidizing treatments. Hydrostatic pressure is used to break the capsules. This action releases powerful pressure waves—to remove scale and other deposits, break emulsion blocks, and to initiate fractures.

FLAC*

This new fluid loss control additive for cement is a major breakthrough in both squeeze and casing cementing techniques. It cuts fluid loss to almost any desired extent without affecting other characteristics excessively. Supplies are limited at present, but operators are invited to familiarize themselves with FLAC so it may be used when it becomes more available.

SLICK WATER (J-100)

This is Dowell's new, improved thickening and friction reducing agent for fresh water. It effectively improves the sand-suspending qualities of water. More important, however, is its ability to reduce friction losses and pump requirements by more than one-half as shown on the graph. The result can be better fracturing at lower cost.

New Kidde carbon dioxide portables awarded highest U.L. rating!

Belleville, N. J. — A spokesman for Walter Kidde & Company announced here today that four of the company's new portable fire extinguishers have been awarded the Underwriters' Laboratories highest ratings for their respective capacities. To those interested in fire safety, this means that, pound for pound, these new Kidde units have more fire-killing power than any other carbon dioxide extinguishers on the market today.

Available in 15 and 20 pound capacities, in either squeeze valve or trigger models, these power-packed Kidde units feature new hose and discharge horn assemblies, which are responsible for their extra fire fighting ability. The new assembly is supplied also with Kidde's 10 pound carbon dioxide portable which has a U. L. rating not exceeded by any other extinguisher of its capacity. This hose-horn combination is also being offered as a replacement unit for existing 10, 15 and 20 pound carbon dioxide units, and when attached will upgrade their effectiveness equal to the new ratings.

For more information on these top-rated Kidde carbon dioxide portables write Kidde today.

Kidde

Industrial and Marine Division
Walter Kidde & Company, Inc.
654 Main St., Belleville 9, N. J.
Walter Kidde & Company of Canada Ltd.
Montreal — Toronto — Vancouver

nipples made from cold-drawn bars. Included is the test procedure, actual test photographs, and a summary of results. Source: **Exner-Dodge, Inc., P.O. Box 565, Coffeyville, Kans.**

Fire Hazards in Industry

. . . guide book (12 pages) offers technical information on various means of combating fire on marine docks. Among subjects covered are portable extinguishers, fire-hydrant systems, water-sprinkler systems, and methods of using carbon dioxide and dry chemicals as well as foam. Techniques of foam application discussed include portable nozzles, monitor nozzles, and fixed outlets. The manual includes schematic drawings of typical installations. Source: **National Foam System, Inc., West Chester, Pa.**

Offshore delivery

. . . nets bonus as explained in a new publication, yours free upon request. It shows how three companies engaged in offshore drilling operations realize substantial returns in savings and efficiency by using pneumatic bulk-handling methods. The four-page report, entitled "Bulk Deliveries Offshore Go Modern," explains why the companies have found it advantageous to replace sack deliveries with less expensive, faster methods of handling such materials as mud, cement, and barium sulfate. Examples are given of operations which have allowed one company to double delivery rate at an estimated 75% saving in labor costs. Fact file ER-13-2 also discusses the development and operation of a "floating warehouse" which serves as a shore supply point on navigable inland waters. Included are five photos of typical offshore bulk-handling systems. Source: **Fuller Co., Catasauqua, Pa.**

Carbon dioxide

. . . and its uses are detailed in a new 24-page booklet covering the history, main applications, properties, manufacture, supply, and distribution of carbon dioxide in gaseous, liquid, and solid forms. One section is concerned with supply systems used to provide carbon dioxide according to the particular needs of the user. Form ADPC 41 also details specialized regulating equipment and controls for carbon dioxide, as well as technical sales services available. Source: **Pure Carbonic Co., 150 East Forty-second Street, New York 17.**

brass tacks

FROM HALLIBURTON

Five stage job in New Mexico

Hydra-jet initiates fracture in Colorado well

11,000 ft. Vis-O-Frac job in Alabama

Sandoil job gives big yield in Aux Vases (Ill.) sand

FRACTURING FACTS

This new well in Lea County, New Mexico, was treated at five intervals from 4,161 to 4,436 feet in the Grayburg Sand with Halliburton's Sandoil technique. A total of 54,300 gallons of refined oil and 80,000# sand were injected into five zones, each isolated with Halliburton HM Straddle Packers. This well – static before treatment – was still flowing its allowable 3½ months after fracturing.

By using Halliburton's Hydra-Jet tool to initiate fracture below 9,000 feet in this old well in Rio Blanco County, Colorado, breakdown pressure in open hole was lowered to 2800 psi. After fracturing the Green River Formation with 40,000 gallons of Waterfrac prepared with Halliburton's ***New*** WG-4 gelling agent and 45,000# 20-40 Ottawa sand, gas flow was quadrupled. Although many other types of fracturing treatments have been employed in this area none gave increases comparable to this technique.

Halliburton's Vis-O-Frac was used to fracture the Upper Rodessa at about 11,000 feet in a well in Mobile County, Alabama. The low friction loss properties of this gelled lease crude permitted the injection of 55,000 gallons and 75,000# 20-40 sand (up to 1¾#/gal) down the tubing and annulus at pressures of 4500-5200 psi and an average rate of 17 bbl/min. This new well (listed as non-productive upon completion) recovered 27 barrels per hour immediately after fracturing and recent reports put production at 244 barrels flowing per day through ⅛" choke. All offset wells are pumping.

After a 2 bbl. per hour start, this new well in White County, Illinois, was treated with 26,000 gallons of lease oil plus 600# of Halliburton FL-2 to help control fluid loss. Sand used in this well was 20,000# 20-40 followed by 10,000# 10-20.
Depth of the interval treated in the Aux Vases sand was 3,116 to 3,143 feet. After the job, test flow showed 80 bbls. per hour . . . and after four months, flow rate was still an impressive 120 bbls. per day through 5½" casing.

SET YOUR OWN RECORD! NEXT TIME...CALL HALLIBURTON

WORLD'S LEADER IN FORMATION FRACTURING

HALLIBURTON **FRACTURING SERVICES**

HALLIBURTON OIL WELL CEMENTING COMPANY – DUNCAN, OKLAHOMA

Electro-Motive power sets drilling record . . .

Kermac 46 hits 10,000 feet in 4 days, 22 hours

Kermac 47 strikes same depth in 5 days, 18 hours

Using three Electro-Motive 900-hp generating units to power electric drive motors on draw works, rotary and mud pumps, Kermac 46, drilling for Gulf Oil Corp., cut the established 10-day drilling record in half. This was accomplished by using heavy bit weight and high rotary speed.

Rotating at 150 to 275 rpm, rotary speed was slowed by adding weight to the bit rather than reducing rotary power. In spite of heavy loading, only five bits were used.

Direct current motors on Electro-Motive equipment are series wound, a factor that makes possible smooth and rapid acceleration of loads with positive control of speed and torque. Thus, accurate control of horsepower can be maintained over a full range of rotating speeds. Simple, single-cabinet controls provide the driller maximum flexibility in power distribution to shorten drilling time, lower costs.

This same drilling method of high rotary speed and heavy bit weight was utilized on Kermac 47 when it reached 10,000 feet in 5 days, 18 hours.

Electro-Motive Power is power to make hole fast; flexible to meet varying drilling conditions; simple, accurate controls; matched components, designed and built by *one* manufacturer—reasons why both land and offshore rigs are successfully reducing drilling time and costs. Why not ask your Electro-Motive representative for full details?

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS · LA GRANGE, ILLINOIS

In Canada: General Motors Diesel Limited, London, Ontario
Petroleum Industry Sales Offices: Tulsa, Oklahoma; Houston, Texas; Dallas, Texas; Morgan City, Louisiana; Pasadena, Calif.

▶▶▶ Equipment Men Notes

Southwest Engineers, Inc.,

J. M. Haring

. . . has been incorporated by Southwest Industries, Inc., as a subsidiary corporation to specialize in engineering and design of facilities for the processing of oil and gas.

Principal officers of the new Houston firm are: J. M. Haring, president; C. B. Kilgore, vice president; and Emil G. Nasser, vice president. Haring had been serving with Southwest Industries prior to his new appointment. Kilgore was associated with Fluor Corp., Ltd., before joining the new firm, and Nasser had served with Fluor Corp., Ltd., and Shell Oil Co. before his new association.

C. B. Kilgore

E. G. Nasser

Orbit Valve Co. moves

. . . its Houston warehouse and office to 6823 Northampton Way. L. E. Wallace, general sales manager, announced that Ralph H. Soape, Orbit's Gulf Coast sales manager, will head the new facility.

The 3,000 sq. ft. of floor space represents an expansion of sales and service to operators in the area. The new warehouse is completely stocked to serve wellhead manufacturers and supply stores on the Gulf Coast and South Texas areas.

Dowell Division opens

. . . a new California headquarters in Bakersfield to provide West Coast operators with all of the well-stimulation techniques available in other parts of the United States.

Engineers, equipment, and operators have been transferred from Dowell's Rocky Mountain headquarters at Farmington, N. M. Of particular interest will be high-pressure pumping equipment used to inject chemicals into producing formations more than 2 miles below the surface.

Manager of the California operation is D. J. Mack. In charge of Bakersfield operations is J. W. Clifford, Jr., and J. B. Ritchie is the service sales engineer.

Musgrove Specialty Co., named

. . . representative in the Houston area for Udell, Inc.'s line of chemical injectors and pumping equipment, according to Clarke W. Polk, Udell's vice president and sales manager. Musgrove has had more than 25 years of sales and engineering experience in the oil and chemical industries, most of which have been devoted to the sale and development of emulsion breakers and paraffin, scale, and corrosion control.

R. H. Huffman is appointed

R. H. Huffman

. . . Shreveport branch manager of Delta Tank Manufacturing Co., Inc.'s oil field-equipment division, according to Ross B. Baze, vice president. Huffman had been in petroleum - equipment sales before being named manager of Delta's new direct-to-the-customer sales and service program.

The Shreveport branch is one of several sales, service, and stocking points being established in major oil-producing areas.

EARL HOLLANDSWORTH IS MADE Chief Roughneck of 1960 by Lone Star Steel Co. Here he is shown (left) receiving the award from the 1958 winner, Guy I. Warren, during a luncheon sponsored by Lone Star at the recent TIPRO meeting at Tyler, Tex. Hollandsworth is a pioneer in the oil industry, dating his career from California's Signal Hill oil field. Now living in Longview, Tex., he and his partner of many years, Lee Travis, operate both Hollandsworth Drilling Co. and Hollandsworth Oil Co. with production holdings in most producing states.

Henry R. Cabell is appointed

. . . sales representative for M. H. Jackson Pipeline Supply Co. He will concentrate his initial sales efforts on the distribution of industrial rubber products of Gates Rubber Co. In making the announcement, M. H. Jackson, company president, stated that the acquisition of the Gates pipeline supply product line will include pipeline scraper cups, V-belts, multiple V-belt drives, heavy-duty sheaves, industrial hoses and couplings, molded rubber goods, and rubber-lined tanks.

Venezuelan representative

. . . named by R. G. LeTourneau, Inc., Longview, Tex., is Lorenzo Bustillos M. & Cia. Sucs. C. A., of Caracas. The firm will represent LeTourneau in the sale of mobile island cranes and other construction and logging equipment.

In addition to its sales staff, the firm also maintains a complete service and parts department. Originally established in 1905 as a hardware distributor, the firm branched into industrial supplies and heavy-equipment sales. Recent sales by the company include cranes, batch plants, and drilling equipment being used in building a bridge over Lake Maracaibo.

W. J. Berk heads oil sales

W. J. Berk

. . . for Taylor Instrument Cos. as divisional sales manager in charge of sales of firm's industrial products to the petroleum and power industries. He succeeds R. N. Pond who has undertaken a special assignment with the application engineering department.

Berk has been with Taylor for 10 years, 5 of them as an application engineer and 5 as manager of petroleum sales.

J&L Supply Division makes

. . . four changes in its field sales force according to an announcement by W. L. Wolfe, vice president, sales. B. J. Rust, salesman at Anson, Tex., has been shifted to salesman at Big Springs, Tex., and V. I. Ginther, salesman at Hill City, Kans., has been shifted to the Tulsa warehouse as salesman.

J. T. Webster, sales correspondent at Tulsa, was promoted to salesman at Williston, N. D., and A. B. Ed-

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The Reader Service Department,
THE OIL AND GAS JOURNAL
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wards, sales correspondent at Tulsa, was boosted to salesman at Healdton, Okla.

Jim Sayers Boosted

Jim Sayers

. . . to foreign sales manager of Smith Tool Co., according to Arthur S. Marshall, vice president, sales. At the same time Art Hawkins was appointed to fill the vacancy left by Sayers as manager of Canadian operations. Chuck Petrie became coastal division manager, filling the post vacated by Hawkins.

Art Hawkins

Chuck Petrie

Sayers will headquarter at the company's main office and plant in Compton, Calif.; Hawkins will go to Edmonton, Alta.; and Petrie will go to Ventura, Calif.

O. V. Coke goes to Wichita

. . . as district engineer-machinery and equipment sales and service, for Oil Well Supply Division of U. S. Steel Corp. The announcement was made by Mark Barkhurst, Mid-Continent area manager of Oilwell.

Coke first joined Oilwell at Oklahoma City in 1952 and has since served there as field representative and assistant district engineer-machinery equipment sales. He has also served the company in various capacities at El Dorado, Liberal, and Wichita, Kans.

Magcobar makes Jep Woody

Jep Woody

. . . sales coordinator for the West Texas region, according to I. W. Hoskins, senior vice president, marketing. Woody had served as sales representative in the region's drilling-mud department until this promotion. Harry Allred, sales and service engineer at Mineola, Tex., Southeastern region, will succeed Woody in the West Texas region. At the same time the West Texas regional office was shifted from Fort Worth to Dallas to accelerate sales and service to customers in the area.

PIEA, PESA elect officers

. . . for the 1960-61 term. C. E. Upson, general superintendent of communications, Natural Gas Pipe Line Co., of America, Chicago, was elected president of Petroleum Industry Electrical Association and John D. Trilsch, Trilsch Corp., Houston, was elected president of Petroleum Electric Supply Association, the suppliers' affiliate of PIEA.

Other officers of PIEA are: E. B. Dunn, Atlantic Pipe Line Co., vice president, and Fred S. Jones, Platte Pipe Line Co., secretary-treasurer. Directors are D. R. Wofford, James Bowen, C. D. Campbell, L. E. Cook, and MacKinley Rhodes.

Named to the board of PESA are: Felix House, Pat Wilson, Harry Holquist, Gene Tuel, George Ullrich, Pat King, Theil Sharpe, Haskell Shelton, W. H. Thomson, C. A. Gunn, Marvin Gunter, and Trilsch.

Sales organization changes

. . . have been announced by R. E. Dunn, marketing manager of Garrett Oil Tools, Division of U. S. Industries, Inc. Glen H. Denison has been

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RIVER DIVERSION • BANK PROTECTION • PILE DRIVING
KENNETH W. HENSON
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WICHITA FALLS, TEXAS
RESERVOIR ENGINEERING
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Cost Estimates, Design, Installation
FIELD SUPERVISION
Phone 723-2167

W. C. NORRIS VALVES
Field Tested and Approved
150 psi working pressure
WRITE FOR NEW VALVE BULLETIN
P. O. Box 1739, Tulsa

made manager of the South Louisiana district with headquarters in Marrero. Replacing Denison as district manager in Houston is J. W. Staples, Jr., who has served as branch manager in Odessa.

Larry Johnson has been transferred to the Odessa office as lead sales engineer. A new agent, L. A. Christopher Co., Denver, has been appointed to handle Garrett's equipment in the Rocky Mountain and Four Corners areas. Christopher has offices in Durango, Colo., and Powell, Wyo., in addition to its Denver headquarters.

E. P. Hayes named

E. P. Hayes

. . . consulting engineer and assistant in the sales of Lufkin pumping units and engines in all oil-producing areas by L. A. Little, vice president and sales manager of Lufkin Foundry & Machine Co., Lufkin, Tex. Hayes has been in the oil industry for 30 years, dating back to employment as a petroleum engineer with the Bureau of Mines in Bartlesville, Okla. He will headquarter in Houston.

Tyson Smith Co. names

. . . J. B. Reeves as Louisiana branch manager with headquarters in Lafayette. Before joining the process-equipment distributor and manufacturer, Reeves had served with Magnolia Petroleum Co., Union Tank Division, and Mid-Continent Supply Co.'s Delta Tank division. At one time he operated his own oil-field supply service.

"Flolight" Generator Control Panels
"Floair" Forge Blowers
"Rumba" Shale Shaker
THESE QUALITY-BUILT HUTCHISON PRODUCTS ARE AVAILABLE THROUGH SUPPLY STORES EVERYWHERE
"Flolight" Power Distribution Panels
"Flolight" Floodlights
Electric Motors and Motor Controls
"Flolight" Derrick Lighting Systems
"Flolight" Power Distribution Systems for Camps
HUTCHISON MANUFACTURING COMPANY
P. O. BOX 9335 • HOUSTON 11, TEXAS
A SUBSIDIARY OF REVERE ELECTRIC MANUFACTURING CO.

Neal Clayton has joined

. . . Geophysical Exploration Co., Houston, as supervisor of field operations. He will direct and coordinate crew operations in Texas and Louisiana from headquarters in Houston. Clayton, whose experience in geophysical prospecting covers 23 years, has held assignments in all major oil-producing areas of the United States. He has served with Humble Oil & Refining Co., Magnolia Petroleum Co. and Sohio.

Frank Wheatley companies

. . . expand their sales forces, including appointment of five men to top jobs in the United States and Canada. Frank Wheatley Corp. has named J. S. Tayrien to head its valve sales in the Permian basin area. Don R. Jepson has been made head of

J. S. Tayrien

D. R. Jepson

Wheatley-Taylor, Ltd., in Calgary, Alta., Canada, an expansion of Wheatley Equipment & Supply Co.

Ken Sutton has been made special sales representative for mechanical rubber goods and fittings by Wheatley Corp. His area will be northeastern Oklahoma. Frank Wheatley Pump & Valve Mfr. has made John Greeley head of traveling sales promotion, working with every sales outlet in the United States. The same company named Orbie Sumner chief pilot and service manager, heading intercontinental service and engineering.

Unaflo oil-well cement,

CEMENTING DATA

Job — Hattie S. Welch #1, Jefferson Davis Parish, South Louisiana

Drilling Contractor — The Bullard Drilling Co., Inc., Houston, Texas

Owner — Austral Oil Company Incorporated, Houston, Texas

Job #1 — 7⅝" O.D. casing string set at 10,277' in 10⅝" hole, cemented with 500 bags UNAFLO cement plus 6% gel (slurry wt. 14.7 lbs/gal.) followed by 200 bags UNAFLO cement neat, (16.3 lbs/gal.). Drilling mud wt. 13.4 lbs/gal. Schlumberger temp. log 181° F. Est. static BHT 213° F.

Job #2 — 5½" O.D. liner, 2,146' long, bottomed at 12,000' in 6¾" hole cemented with 320 bags neat UNAFLO cement. Drilling mud wt. at cementing 16.4 lbs/gal. Schlumberger temp. log 255° F. at 12,160'. Est. static BHT 265° F.

Job #3 — 5½" O.D. full casing string tied to top of 5½" O.D. liner, using liner to casing coupling with 100 bags neat UNAFLO cement.

compatible with various additives...

UNAFLO oil-well cement is successfully used neat or with various types of additives in more and more cementing operations. For cementing casing or liner, squeeze cementing, plug-backs or recementing, UNAFLO cement slurries pump easily and set hard to provide an adequate seal. Its retarded set sustains high initial fluidity despite high temperatures and pressures. This allows time for proper placement plus a margin of safety for delays or emergencies.

For more information, write Universal Atlas Cement, 100 Park Avenue, New York 17, N. Y.

Universal Atlas Cement
Division of
United States Steel

U-169

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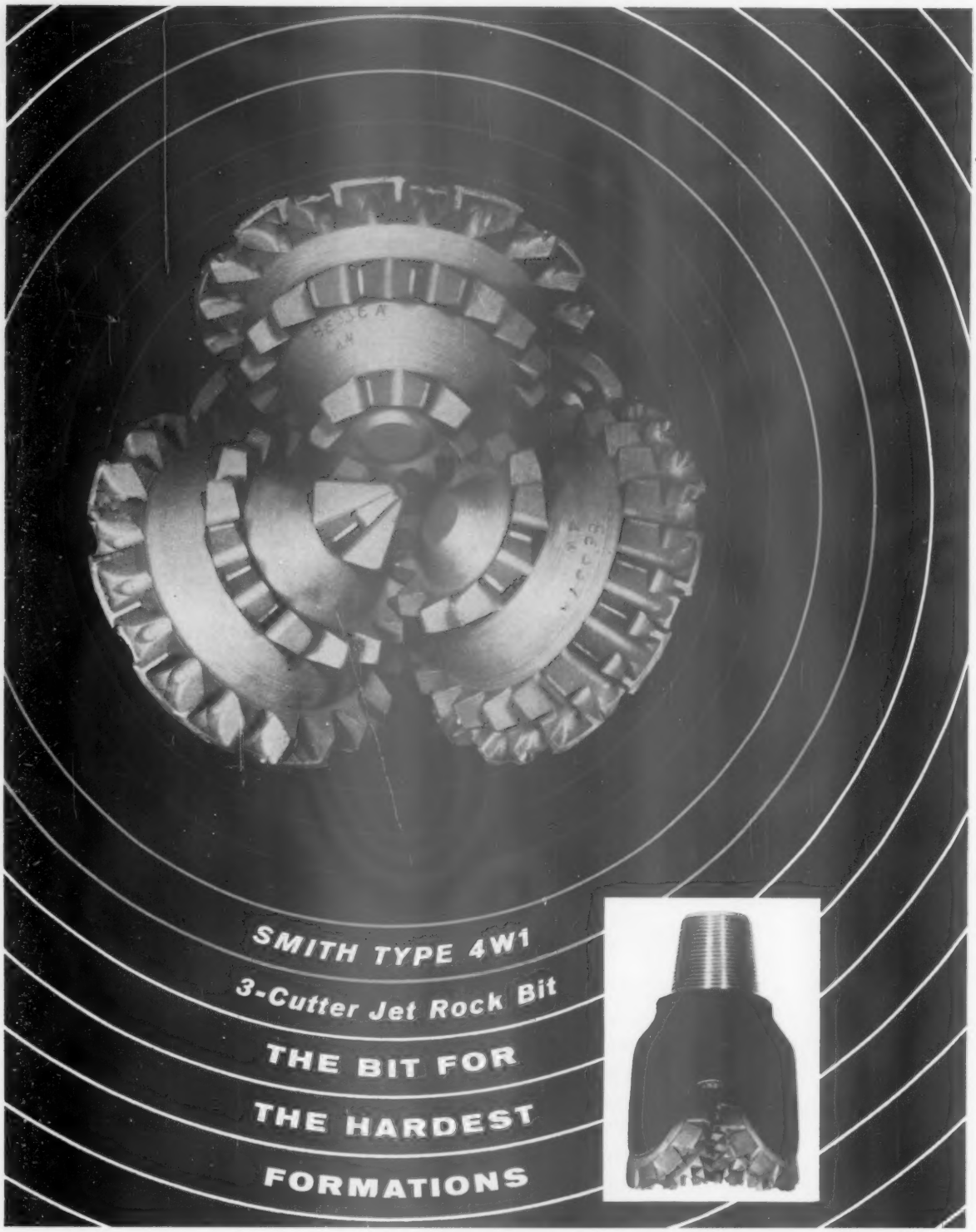

The **Smith Type 4W1** 3-cutter jet rock bit, designed to drill the hardest and most abrasive formations, features... largest possible bearing size to insure maximum bit life under heavy loads... heavily hardfaced, circumferential webs on gage teeth affording greatest possible gage protection... maximum tooth angle to withstand high impact loading... the proper geometry to insure a true-roll and chipping-crushing action required for drilling high compressive strength rocks, such as chert, pyrite, granite, quartzite, and hard sand rock.

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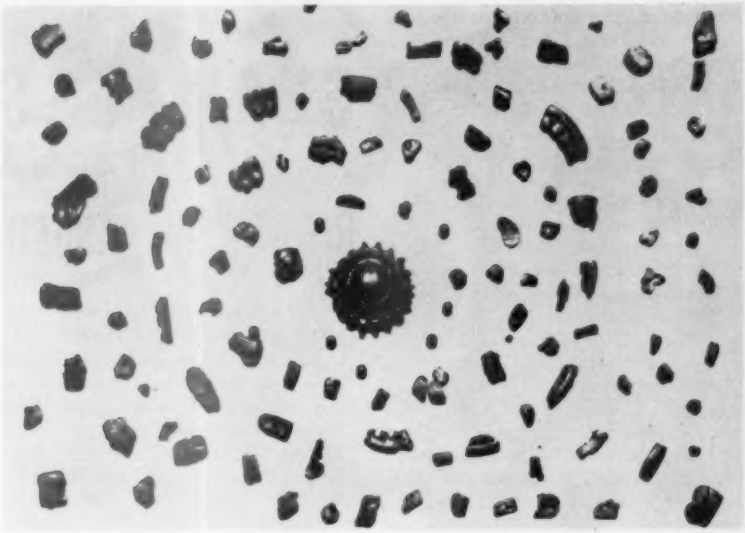
Throughout the World



This junk was fished from an 18,121-ft. hole . . .

THESE men are, left to right, J. D. Mosley, Great Western toolpusher, P. E. Todd, fishing-tool department of Wilson Supply Co., and Bob Foster, GW driller who is holding the jet junk basket.

by these men and this jet basket in a . . .

Deep Texas fishing job

RECORD-BREAKING Rig 44 of Great Western Drilling Co., Midland, Tex., has continued its pace-setting ways since it was first assembled in 1957.

Now the big diesel-electric has made quick work of what is probably the deepest fishing job of its type ever attempted. Its drilling crews successfully and quickly retrieved junk lost in the hole at 18,121 ft.

This is the same rig which drilled its very first well to 23,400 ft. At the time, the well was the second deepest

LOOSE SANDS?

SANDBAN
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Sandban* screen is a new tool for controlling sand production. Sandban screen consists of a slotted aluminum screen, a smaller aluminum or steel screen inside and a permeable network of plastic-coated walnut shells between the screens. Sandban screen is easy to use—and economical. Available sizes: 4-inch O.D. with 1½-inch steel screen inside; 5⅝-inch O.D. with either 2⅞-inch steel screen or 2-inch aluminum screen inside. Other sizes made to order. Ask a Dowell engineer about Sandban screen.

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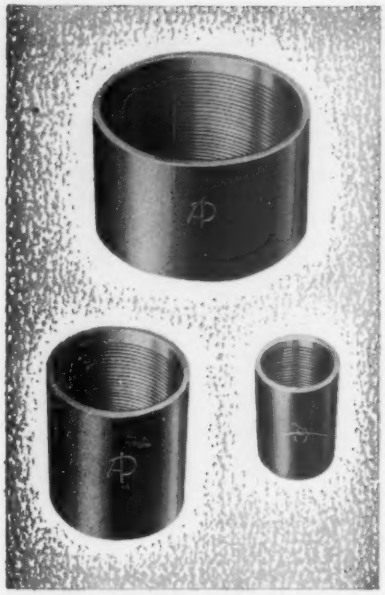

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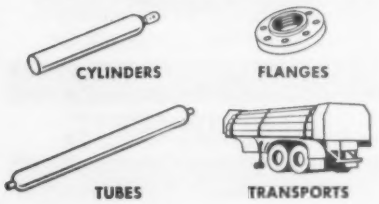

ever drilled; it's still the third deepest.

Recently, the equipment has been drilling Atlantic Refining Co.'s 1 Kelly in a deep-hole kingdom of the oil world—Pecos County, Texas. This well wears a double crown: it promises to be Texas' second-deepest producer, and it is hailed as one of the most important West Texas discoveries of the decade.

Jet junk basket. At the time of its recent superdeep fishing job, the 1 Kelly was already cased with 5½-in. casing. The crew was drilling a plug when a cone was lost off the 4⅛-in. bit. The junk from plug and cones was at the 18,121-ft. mark.

Two runs were made to retrieve the material, both with a Wilson "jet-powered" junk retriever. This tool has small-diameter nozzles similar to those on jet rock bits. When mud is circulated through these nozzles, they have a jet-pump effect on the mud around them. The tool is designed so that the jet-pumped fluid circulates out the top of the tool and back in the open bottom. Thus, the retriever has an action almost like a sand pump: the junk on bottom is actually circulated up into the body of the tool where it can be held by catcher fingers.

The Wilson tool was run by M&B Fishing Tool Co., Odessa. The first run was on a combination of 3½-in. slim-hole drill pipe and 2½-in. internal-flush pipe. With 2,000 psi. on Rig 44's D-700 Emsco pumps, some 110 g.p.m. of mud was circulated through the string and the nozzles of the junk retriever.

After 3 hours of circulating, the string was pulled; the tool recovered all the small pieces of brass from the plug and five bearings from the rock bit. The retriever was run again on the same string. This time, the well was circulated for 1½ hours. When it was pulled, the tool brought up the bit cone and two bearings.

Alberta units change hands

A NUMBER OF DRILLS in Alberta have, or are soon to get, new owners. It was reported that Arnim Drilling Co., Calgary, sold its 10,000-ft. slim-hole rig. Slightly over a year ago this drill first went to work at Virginia Hills for Imperial Oil Ltd.

Moore Drilling Co., Ltd., reportedly will sell its eight rigs either in units or as a package. These are located at Kavenaugh, Coulter, Peace River, Hughendon, Rimbey, and Bentley, Alta.; in Estevan, Sask.; and in Coulter, Man.

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L. W. Bebensee, of Canadian Superior Oil of California, Ltd. (left), and Ron White, of Canadian Oil Cos.', Ltd. (right) present an advance copy of "Oil Fields of Alberta" to Frank J. Gardner, exploration editor of The Oil and Gas Journal. Bebensee is chairman of the publishing committee of the Alberta Society of Petroleum Geologists, and White served as editor of the new ASPG publication.

Alberta geologists compile comprehensive inventory

BY FRANK J. GARDNER

ON A RECENT VISIT to western Canada, this reporter was given a peek at advance press proofs of a new book. And quite a book it is. The Alberta Society of Petroleum Geologists has been hard at work on it for almost 2 years. Under the simple title, "Oil Fields of Alberta," it was finally released 10 days ago as a feature of the AAPG-ASPG regional meeting at Banff.

A geological inventory. A collective effort of ASPG members, this 280-page reference work is a must for the library of anyone who has an interest in Canadian oil. It's the first comprehensive look at what's been accomplished on the Alberta plains since Leduc roared in back in 1947.

L. W. Bebensee, chairman of ASPG's publishing committee, says the book is the brainchild of Bob Erickson, geologist for Great Plains Development Co. of Canada, Ltd.

"He came up with the idea in 1958, and we liked it. Since then, we've done little else but work on it, and we hope we've got a best-seller," Bebensee says.

Ron White, of Canadian Oil Co.'s, Ltd., served as editor of the new book. "We modeled it after similar volumes compiled by the Wyoming and Montana geological groups," he explained, "but we added a few new touches of our own which make it a better book, we think."

Covers the fields. Thumbing through the volume, one gets the feeling that Editor White is much too modest. More than a hundred geologic field maps come to view, many as long foldout jobs in color. Facing the maps are pages filled with discovery stories, geological summaries, development data, reserve figures, production statistics, and reservoir descriptions. Besides the geologic maps, there are many cross-sections and type logs.

As a prelude to the field pages, ASPG has included three major articles—one on the regional geology of the oil-bearing formations, another on variations of formation fluids, and a professional appraisal of the famous Athabasca tar sands.

In usable style. Wisely, the publishing committee chose to bind the book in loose-leaf style, so that new pages may be added, old ones replaced, and the book kept up to date.

"We borrowed that idea from the Wyoming Geological Association," White says, "for it struck me as the best approach to a usable, everyday reference work."

In total, there are 160 field summaries in the book. Taking a closer look at one of them, the reader finds a detailed breakdown on the larger headings. Under "Geology," for example, there are such things as lithology, trap descriptions, regional setting, producing zones, and an interesting item labeled "other shows"—this latter has important implications, of course, for future development.

Under "Reservoir Data," these things come to light: Type of drive, estimated oil in place, estimated recoverable oil, porosity, permeability, zone thicknesses, and characteristics of the fluids.

Such subjects as typical logging practices and completion methods are fully covered in the field summaries, as well as spacing patterns, well tallies, allowables, and market outlets.

ASPG confined itself to oil in this first project. But a companion piece on Alberta's gas reservoirs is definitely in the wind.

When queried about future publishing ventures, Chairman Bebensee outlined plans for four geologic cross-sections of the western Canada sedimentary basin, possibly in color.

"Then, too, we're already at work on a new lexicon of geologic names in western Canada," he added. "It's badly needed, and we hope to have it completed by July 1."

This business of geologists turning publishers is not new. Nearly every geological group has its publications committee. It all adds up to an enriched exploration literature, which automatically benefits the entire oil industry.

Kudos to ASPG, then, for a publishing job well done. It has filled a gap in the Rocky Mountain literature that badly needed filling.

For North America . . .

Needed: bigger gas reserves

GAS is right up there on top with oil as an exploratory objective in North American basins. Through the years since Drake's well, drillers have spent most of their time and money in the search for oil. With the rise in gas consumption in the United States and Canada in recent years there has been a decided new look at our gas potential.

Most of our many petroleum provinces have both gas and oil production. But most of our basins major in oil. A look at the map gives a portrait of the major gas basins on the continent. Some are being proven, some are old-timers, some are just getting started, and there are lots of

BY JOHN C. McCASLIN
District Editor

areas that haven't even been probed. All of the basins on the map have reasons for being there—reasons based on past performance, current discoveries, and the blank ones have had some gas inklings in past years or are thought to be possible gas reservoirs.

The giants. Some of the world's biggest gas reserves are located in North America. Both the United States and Canada have fields to boast about.

The continent's major gas regions now being proved are the Appalachian basin, the Gulf Coast Salt basin, the Edwards trend, Anadarko basin, Green River basin, San Juan basin, the Sacramento Valley, Foothills belt, and northeastern British Columbia.

. . . United States. A dozen states produce 98.3% of this country's natural gas. Texas leads with 41.4% of the U. S. total. Louisiana has 15.45% of the total, followed by Oklahoma with 8.88%, and California with 8.77%. New Mexico, with the second biggest gas field in the country, has only 3.88% of the total.

The Panhandle-Hugoton area of Texas, Oklahoma, and Kansas is the nation's largest single, continuous gas-

"A look at the map gives a portrait of the major gas basins on the continent. Some are being proved, some are old-timers, some are just getting started, and there are lots of areas that haven't even been probed. All of the basins on the map have reasons for being there."

producing area. New Mexico's San Juan gas field is a close second. The Gulf Coast has myriad large gas fields, strung along the coast from Brownsville to South Mississippi. North Louisian's Monroe and nearby gas fields rank with the majors. The entire Appalachian Mountain province has always been a gas giant, but is just now really getting down to the deep gas-exploration business.

... Canada. Five of Canada's provinces produce gas. Two of them, Alberta and British Columbia, have tremendous gas reserves and potential. Big gas fields in these provinces have been tapped in just the past 5 years. Names like Waterton Park, Berland River, Foothills gas belt, Kotcho Lake, and Petitot River have joined the long list of giant gas fields on both sides of the border.

The contenders. Basins where gas exploration has been slow in starting but now bristling with new expectations are the Delaware, Rio Grande embayment, Arkoma, Uinta-Piceance, MacKenzie, and Kenai. All of these areas have gas production. Some have large gas reserves that are years old, but for the most part these basins are on the threshold of their gas careers.

Delaware. This far-western Texas basin has been on the oil and gas-producing list for many years. But both oil and gas exploration have had a hard time of it, particularly in the deeper zones. Recent wildcatting in various parts of the Delaware country is proving it to be one of the nation's most promising future oil and gas provinces. The New Mexico portion of the basin is now experiencing a rash of successful gas discoveries, particularly on the northern shelf and western fringe areas. One of the largest gassers in the region was recently opened in West Texas' part of the basin at Mobil Oil Co. 1 Moore. It flowed 102 M.M.c.f.d. from deep Pennsylvanian rocks, and currently is the deepest regional producer at below 15,000 ft.

Rio Grande-Edwards. The Rio Grande embayment and associated Edwards trend is a virgin gas province that expects to become one of the most productive in future years. Deep Edwards lime gas fields are popping up along a 300-mile trend across South and Southwest Texas to the Rio Grande. It has been a long, tedious hunt, but of late is beginning to pay for itself.

Arkoma. This two-state basin is the newest contender as a gas bowl. There has been scattered gas production in eastern Oklahoma and western Arkansas for some time, but not until last year did things begin to move on the exploratory front in the hill country. Serious industry drilling programs have uncovered an unusually thick Pennslyvanian section with many pay sands. Look for Arkoma to become one of the largest gas sources in the U. S. in the next few years.

Uinta-Piceance. Western Colorado has seen an upsurge of gas success in the past 3 years. Fields are becoming more numerous as each drilling year closes. Production in this region comes from Triassic through Tertiary rocks. The gas hunt here blossomed shortly after the Pacific Northwest Pipeline went through the basin. This line has influenced many a gas hunter in western Colorado, eastern Utah, and in Wyoming's Green River basin. Since the pipeline was announced several years ago, Green River basin has emerged as the No. 2 gas basin in the Rockies.

MacKenzie. There are three fields in this frozen expanse—new Peel Plateau, Celebita Lake, and old Norman wells. Arctic exploration is on the verge of becoming oil and gas's new frontier. The Peel Plateau and Celebita Lake discoveries have occurred in the past year, paving the way for a big push into the oil and gas potential of one of the world's biggest regions.

Alaska. First commercial gas production was opened last year on the Kenai Peninsula, giving gas to Anchorage. The field will be further developed as consumption demands. Gas and oil production are both new to this state, but the future of petroleum there should be one of oil's real sagas in years to come.

The hopefuls. Nine continental regions don't have any gas production, but there are good signs from the past and present that they will have.

... Great basin. This huge chunk of the western United States has only one currently producing oil field and no producing gas fields. But as far back as 1892 gas was being supplied to Salt Lake City from the shallow Farmington gas sands. The occurrence of bitumen, oil seeps, and shallow old Virgin oil field on the west side of Kanab basin, plus good showings in Periman, Pennsylvanian, and Mississippian strata on the northeastern side of the basin give good indications of gas and oil in commercial quantities in this southwestern Utah locale. Another regional basin of promise is the Kaiparowits in southern Utah and northern Arizona. Numerous oil and gas shows and favorable geology make this basin very attractive to exploration.

... Black Mesa. This northeastern Arizona basin has four small gas fields. All but one have been opened in the past 3 years. Everything but statistics point to the northern edge of the basin becoming a worthwhile member of the gas family. Pennsylvanian, Mississippian, and Devonian sections all offer good possibilities for the gas seekers.

... Paradox. This basin is a strong candidate for the gas majors, despite its membership in the oil giants. The recent Northwest Lisbon Devonian oil discovery also had substantial gas flows in Mississippian. A sister well in San Miguel County, Colorado, at Southeast Lisbon, also has Mississippian gas. Recent tests at a second well there promise Devonian gas production. The northern side of the Paradox basin, that area parallelling

the Uncompahgre uplift, will see important gas exploration in the near future.

... Black Warrior. This southeastern United States basin has had both oil and gas production off and on for a long time. None of the fields there has ever amounted to much, however. Like Raton, Black Warrior drilling has come in spurts. But unlike Raton, Black Warrior has some producing fields. Nearly everyone agrees that this southern extension of the huge and prolific Appalachian basin province will some day get out of the doldrums.

... Vale, Bellingham, and Pacific Tertiary. The Pacific Northwest has had but one commercial producing field. It was an oil pool in Washington's Grays Harbor County. There have been scattered gas findings in Oregon, Idaho, and Washington for half a century or longer, but no commercial production. Some gas used to supply local consumers in the backcountry, but a lack of intensified exploration has left this section of the nation high and dry on the producing column. Exploration men are bound to take another look up that way in the future, and we should see first production being opened in Oregon and Idaho, while Washington needs a good substantial discovery to confirm its one-well field.

... Raton. This New Mexico-Colorado basin has been a failure in both the oil and gas courses. Gas has been found in varied amounts through a long period of drilling, but there is no current production. Sporadic drilling campaigns have attacked this stubborn frontier in recent years, but none has met with success. The geology is there. Based on previous showings in the many wells dug in Raton basin, this area may soon get its first hit.

... Alaska's Gubik. Gas is already known to be in this reserve in great quantities. None has been produced for commercial use, however. This basin will one day be one of the largest oil and gas producers on the continent. This honor awaits development and demand.

... St. Lawrence. Eastern Canada's St. Lawrence Valley has a few small gas fields. There has been scattered interest in the region in recent years—interest that even moved a wildcatter to drill a well in Vermont. Past successes and current production reveal no reason why Quebec and the Maritimes won't become major gas producers.

The gas picture. Gas reserves in the United States are lagging consumption. There are some bright spots, however. Total gas completions in U. S. fields last year continued their 2-year rise. But the upswing is still not sharp enough. Marketed production of natural gas showed a 6.7% gain over 1958. On the other side, proved gas reserves rose only 2.6%. At the present rate of gas consumption (11.7 trillion cubic feet) our reserves will last only 22 years at the present figure of 262.6 trillion cubic feet. More gas **must** be found.

Nebraska drilling project set

THEY'RE GOING to try again on Nebraska's Chadron arch.

Miami Petroleum Co. of Abilene, Tex., will drill seven wildcats in Sioux County in the northwestern part of the state, 50 miles north of nearest production in Scotts Bluff County.

Locations have not been announced, but reportedly, the seven wells will be scattered over an area in 29-31n and 53-57w. Depth objective will be the Morrison Jurassic at 4,450-5,200 ft. There have been less than 10 wildcats drilling in a 15-township area of this county. Deepest one was Continental Oil Co. 1 Wear in 10-29n-57w. That well went to Precambrian at 7,665 ft. There were some slight oil shows on cores and drill-stem test in Minnelusa Pennsylvanian. The California Co. drilled to 7,284 ft. in granite at a well in 27-30n-56w with no shows. J. Ray McDermott, Jr., J. F. Stone & Son, J. M. Huber Corp., and Thomson Drilling Co. drilled dry holes in 30n-56w, all dry at less than 5,100 ft. in the Morrison. Eddie Fisher found no shows in three 1957 tries in 29n-5w, 54, and 55w. Gulf Oil Corp. drilled below 4,400 ft. to Lakota at a wildcat in 33-30n-53w.

The Chadron arch has seen sporadic waves of wildcatting in recent years, but success is still to come. This regional feature is the northwestward extension of the Cambridge arch, which in turn is brother to the Central Kansas uplift. Chadron is the northeastern extremity of Denver basin.

Nebraska well tests Cambrian

ANOTHER WILDCAT in southern Nebraska's Redwillow County is testing Cambrian oil. The new discovery is Burch Drilling Co. 1 Nokes in C SE SE 13-2n-27w.

Some gas was recovered in pipe and 5 ft. of free oil on drill-stem test of Reagan at 3,520-30 ft. Earlier, recovery was 1,146 ft. of free oil and 240 ft. of muddy oil on drill-stem test of the Lansing-Kansas City at 3,248-3,302 ft.

Location is 7½ miles east of Ackman Pennsylvanian field and 4 miles south of Murfin Drilling Co. 1 Barth in C SE SW 25-3n-27w. That well is also an apparent Cambrian producer. Recovery there was 305 ft. of free oil and 120 ft. of mud-cut oil on test at 3,395-3,425 ft.

Big gas flow recorded at Oklahoma field well

Southwestern Oklahoma's Southwest Rainey field, Washita County, gained a big gas-condensate well at Fain Porter Drilling Co. 1 Dunlop in NW SW NW 31-8n-16w.

The well flowed from 25 to 35 M.M.c.f.d. with good show of condensate. Tests through various chokes included 1,710 M.c.f.d. through 9/64-in., 3,300 M.c.f.d. through 15/64-in., and 4,440 M.c.f.d. through 19/64-in. Flow on 22/64-in. was 5,730 M.c.f.d., 7,300 M.c.f.d. through 28/64-in. Production is from the Springer Pennsylvanian sand at 5,330-40, 5,370-80, and 5,390-5,400 ft.

Southern Oklahoma. Cities Service Oil Co. 1 Brown-K, C SW NE 16-4n-3w, New Hope field, Garvin County, flowed 18 bbl. of condensate hourly and 5,200 M.c.f.d. through 13/64-in. choke from perforations in the McLish Ordovician sand at 9,502-35 ft. From the Oil Creek sand at 9,714-58 ft. the well made 2,900 M.c.f.d. on 40/64-in. choke. The Third Bromide Ordovician was good for 25 bbl. condensate per hour on ½-in. choke from 9,266-9,345 ft.

Kingfisher County. Eason Oil Co. 1 Petru in C NE NW 21-19n-6w, East Hennessey field, flowed 4 bbl. of oil per hour from the Mississippian Meramec lime through open hole at 6,880-6,980 ft. It flowed 30 bbl. per hour on 20/64-in. choke from the Manning Mississippian sand at 6,636-93 ft.

Another well is the Jones and Pellow 1-C Schimanek in C SW NE 16-19n-6w. It flowed 280 bbl. of oil in 12 hours on 24/64-in. choke from Manning perforations at 6,624-34 ft. The Meramec at 6,828-47 ft. also had good flows.

Carter Division of Humble Oil & Refining Co. 1 Houghton is a dual

producer in C NE SE 14-18n-7w. The Manning made 227 bbl. in 12 hours at 6,920-72 ft. Flow was on 3/8-in. choke. From Oswego at 6,524-38 ft. it swabbed 59 bbl. of oil and 23 bbl. of water per day.

Oklahoma Panhandle well confirms Morrow strike

A recent Morrow gas discovery in central Beaver County in the Oklahoma Panhandle has been confirmed. Confirmation discovery is Stekoll Petroleum Co. 1-35 Laughrin in C SW NE 26-3n-23eCM, 4½ miles north of Elmwood.

The well had a calculated open flow of 17 M.M.c.f.d., plus 20 bbl. of condensate per million. Perforations were in the lower Morrow Pennsylvanian at 7,524-37 ft. The discovery well of this new field is the 1-26 Ellis in C NE SW. The Laughrin well made 2 M.M.c.f.d. from upper Morrow at 7,111-22 ft.

Texas County. Hamilton Brothers, Ltd., 1-13 Hicks in C NW SE 13-5n-12eCM, Texas County, is a triple-zone discovery.

The well flowed 5,210 M.c.f.d. at 6,304 ft. At 6,039 ft. the well flowed 7,304 M.c.f.d. on 1-in. choke. In the Cherokee at 4,342 and 5,423 ft. the well made 12,800 M.c.f.d. on 2-in. choke. The deeper pay was Morrow. This well is 20 miles northwest of Guymon.

First of several wildcats drilled east of Kansas City

Drilling is under way on the first of several wildcats in Lafayette County, some 50 miles east of Kansas City, Mo. The first well is Missouri Development Co. 1 Margaret Adams in the SW¼ 13-50n-26w. Drilling is below 340 ft. on the way to granite.

This first well in a series is on one of the five lease blocks consisting of about 102,000 acres. One block centers at Higginsville, Mo. A block at Alma, at Wellington, one near Napoleon and one at Emma make up the remaining four blocks.

Forest City basin. The new drilling lies on the east side of Forest City basin. Nearest production lies northwest in the Kansas City-St. Joseph area of the basin. Surface rocks in Lafayette County are lower Pennsylvanian in age. Farmers in the area have used gas from water wells in the past years. The gas is from the Cherokee Pennsylvanian, while water comes from the Mississippian rocks. There are five significant structures in Lafayette County.

Texas drillers keep busy

PROLIFIC two-zone production is reported at a discovery in Stephens County, West Central Texas. Harding Brothers 1 Fay Cox is the well in Section 662, TE&L Survey, 2 miles south of Throckmorton County line.

Dual completion was from Mississippian at 4,390-4,404 ft. and upper Caddo perforations at 3,571-91, 3,605-7, and 3,729-37 ft. On the Mississippian 6-hour test the discovery made 353 bbl. of oil, or 1,412 bbl. daily. Flow was on 20/64-in. choke. From Caddo it flowed 142 bbl. on a 24-hour test through 24/64-in. choke. Harding field is the suggested name for the new area. Nearest Mississippian production is from Eloise Kay field, 2 miles southeast. The Harding discovery is 1¼ miles northeast of North Tipton multipay field.

Texas gas-condensate field may have oil

The South May field area of Kleberg County in Southwest Texas, formerly a gas-condensate reservoir, may have oil production. Arkansas Fuel Oil Corp. 1 L. B. Strubbart in Lot 31, Block 22, Theo. F. Koch Subdivision of Riviera Lands, 3 miles southeast of Riviera, tested oil from perforations 8,754-57 ft. Oil flow at the rate of 184 bbl. per day on a 5-hour gage. This well was intended to test the Massive 5 zone, not presently producing in the field.

The operator is now testing at 8,671-77 ft. There are seven gas reservoirs in South May—Middle 4, Massive 2, Massive 4 in Block "A"; Massive 1, Basal 1, Basal 2, and Basal 4 in Fault Block "B."

Palo Duro shows new success signs

There are new signs of success in the Palo Duro basin, the on and off province in the Texas Panhandle.

Not since the opening of Shell Oil Co.'s Alamosa Virgil Pennsylvanian oil field and Southeast Alamosa Missouri Pennsylvanian oil field and Tascosa granite-wash oil field has this basin made such news.

In Randall County, 5 miles east of Canyon, Texaco Inc. 1 G. H. Leaseberg is bottomed at 8,195 ft. This remote wildcat has been mostly tight since drilling began. Rumors have it that oil was found in Wolfcamp.

Location is in Section 109, Block 6, H&GN Survey. There is no production in this county. Nearest producers are 35 miles north in Panhandle field.

Bivins Ranch. Shell Oil Co. 1-207 Bivins Ranch, 12 miles north of Amarillo in Potter County, 8 miles south of Panhandle field and 7 miles northeast of Bush Dome helium field, recovered 15 ft. of oil and gas-cut mud with a trace of free oil from Virgil granite wash at 5,639-78 ft. This well is 2½ miles southwest of Brown dolomite wildcat which is trying to complete. It is the Lee T. Bivins 1 Pedrosa, 16 miles north of Amarillo. The Pedrosa well also had some shows in Red Cave Permian. Shell's Bivins Ranch well is in Section 207, Block 2, AB&M Survey. The Pedrosa well is in Section 3, Block 4, ACH&B Survey. These two wells and the Texaco well plus a new helium prospect at Texas Gulf Producing Co.'s well 7 miles south of Panhandle field in Carson County should give the Palo Duro basin a new aspect.

Good well finaled in Texas' Palacios field

The 1 Kubela Gas Unit in Palacios field, Matagorda County on the Texas Gulf Coast, was completed by Ohio Oil Co. for an absolute open flow of 36,500 M.c.f.d. plus condensate flowing for a gas-liquid ratio of 36,800:1.

This good well flowed from Frio perforations at 8,870-8,949 ft. Location is 2 miles northeast of Collegeport on the J. C. Hall Survey, A-197.

Chocolate Bayou. New gas-condensate production is reported at Chocolate Bayou field in Brazoria County.

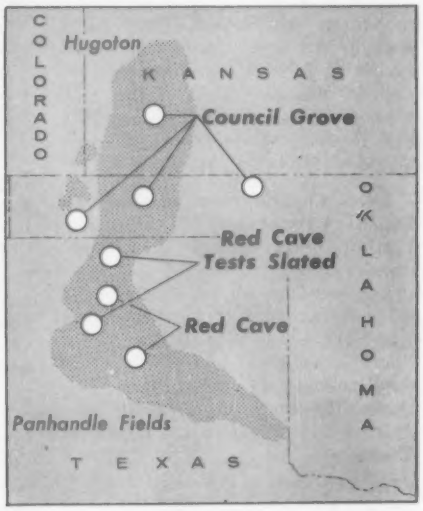
Texaco Inc. 18 A. M. Wieting Gas Unit O/A had an absolute open flow of 7,600 M.c.f.d. from Rycade VI sand at 10,530-54 ft. and 10,562-75 ft. Location is 5 miles southeast of Liverpool on the HT&B Survey, A-226.

South Texas. Testing is under way at a deep Wilcox 11,000-ft. test in Zapata County. The discovery is Crescent Oil & Gas Corp. 1 Serapio Vela, newest well on the deep Wilcox trend in Zapata County. The well flowed 2,514 M.c.f.d. from three sets of perforations at 11,052-62, 11,136-50, and 11,192-11,208 ft. Location is on common corners of lots 10, 11, 26, and 27 on C. M. Doty Subdivision, El Grullo Grant, 8 miles southeast of Zapata. Nearest Wilcox production is 2 miles north at Katz Oil Co.'s Herlinda Vela Wilcox field. That discovery went to 10,450 ft.

Drillers show new regard for Panhandle Permian

PANHANDLE PERMIAN PRODUCERS				
System	Series	Group	Member	Area
PERMIAN	Leonard	● Clear Fork	● Tubb ● Red Cave	Texas
		● Wichita	● Panhandle ● Hollenberg	Texas Okla., Kansas
	Wolfcamp	● Chase	● Herington ● Brown Dol. ● Krider ● Winfield ● Towanda ● Florence ● Wreford	Kansas, Oklahoma Texas
		● Council Grove	● Moore County ● Cottonwood ● Neva	Kansas, Okla. Texas.

These are new leaders



PERMIAN EXPLORATION in the Panhandle-Hugoton region has rejoined the ranks as a prime objective. Pushed to the wayside in recent years by the onrushing tide of pre-Permian development in the five-state area, Permian rocks are now undergoing a steady and thorough scrutiny—an investigation that led to 11 new gas fields in 16 months.

From 1918. The vast Panhandle-Hugoton field, largest continuous oil and gas-producing area in the world, came into being at the end of World War I. Discovery well of the first Permian field was Amarillo Oil Co. 1 Masterson. It flowed 5 M.M.c.f.d. from 2,382-2,400 ft. in granite wash, setting off a trend of development that now covers 10 counties.

Then, in 1921, Gulf Oil Corp. 2 Burnett opened Permian oil production in the field, firing the booming 1920's oil rush in the Panhandle country. The gas field covers nearly 1,500,000 acres, which in conjunction with the Hugoton field makes it the world's largest. A permeability wall separates the Panhandle gas field from Hugoton field in Moore County, Texas. Oil production spread north from Carson County after the 1921 discovery into Hutchinson County where it grew rapidly.

To Pre-Permian time. After the rush of Permian oil and gas days was over, another period of Panhandle drilling history began with the completion of Sinclair Oil & Gas Co. 1 Charles Lips in Roberts County. This Mississippian oil find sired the present-day pre-Permian campaign that now leads national drilling activity. Most of the post-Lips success came in Pennsylvanian rocks. Huge fields are opening up throughout the northwestern Anadarko basin from the Amarillo uplift northward into the Dodge City embayment. Last year, after many years of silence, the Mississippian section came into focus again.

Back to Permian. Since the opening of Panhandle field more than 29 oil and gas fields have been tapped for Permian production. Most of this activity went on rather quietly, unnoticed by other regional wildcat events. But last year, a definite breakthrough occurred when Cator Tubb sand Permian gas field was opened in Sherman County at Shamrock Oil & Gas Corp. 1 Brown. This well is the only such producer in the county, and was the first Tubb well to be officially designated by the Texas Railroad Commission. Thus, a new producing horizon for the Hugoton-Panhandle region was born. This pay was drilled through in thousands of wells during the maturity of Panhandle field. But no completion in the Red Cave-Tubb was made until 1955 at a Colorado Interstate well, the B-55 Masterson. That well flowed 3,800 M.c.f.d. from 1,455-56 ft. and 1,460-65 ft. in the Red Cave-Tubb, but nothing was done about it for the record until Shamrock's 1959 find. Red Cave is a blanket type, silty sand in the basal part of the Tubb of Clear Fork age. Some wells have made as much as 14 M.M.c.f.d. Only five wells were drilled in the interim between 1955-1959. Last year first Red Cave production was opened in Hutchinson and Moore counties. There are now seven Red Cave areas in the Panhandle.

...**New drilling.** There are now 16 wildcats in

Permian producing areas in Panhandle-Hugoton area

State, County, and Field—	Year disc.	Pay	Pay depth	No. of wells	Remarks
1. Texas; Sherman; Cator	1959	**Tubb**	1,925	1 gas	Only Red Cave producer in Sherman. First officially designated Red Cave well.
2. Texas; Hansford; Cator	1959	Brown dol.	3,058	1 gas	Extends regular Wolfcamp gas pay in Hugoton field.
3. Texas; Roberts; Cree-Flowers	1955	Brown dol.	3,760	17 gas	
4. Texas; Hutchinson; N. Hutchinson	1957	White dol.	3,481	1 gas	
5. Texas; Potter, Moore, Hutchinson; Panhandle	1955	**Red Cave-Tubb**	1,400	10 gas	Officially recognized as Red Cave in 1959.
6. Texas; 8 counties; Panhandle (oil)	1921	Permian & Penn.	1,600-3,500	15,000 oil	Part of world's largest field-still developing.
7. Texas; 10 counties; Panhandle (gas)	1918	Permian & Penn.	1,400-3,800	4,000 gas	Part of world's largest gas field (Panhandle-Hugoton).
8. Texas; Roberts; Quinduno (oil)	1952	Lower Albany-Brown dol.	4,000	188 oil	One of most important fields before Pre-Permian era.
9. Texas; Roberts; Quinduno (gas)	1953	Lower Albany-Brown dol.	4,000	49 gas	
10. Texas; Roberts; Red Deer	1958	Wolfcamp	4,000	7 gas	
11. Texas; Carson; Bobbitt	1960	Brown dol.	3,247	1 gas	
12. Texas; Hutchinson; Paramount	1960	**Red Cave**	1,545	1 gas	
13. Texas; Hutchinson; Bivins	1960	**Red Cave**	1,570	1 gas	
14. Texas; Moore; Sneed 101	1959	**Red Cave**	....	1 gas	First in Moore County.
15. Texas; Moore; Sneed 103	1959	**Red Cave**	....	1 gas	
1. Oklahoma; Cimarron; S. Griggs	1957	Wichita	2,400	2 oil	
2. Oklahoma; Cimarron; S. Griggs	1957	Krider	2,530	2 oil	Discovery dualled in Winfield.
3. Oklahoma; Cimarron; S. Griggs	1956	Winfield	2,510	5 oil	Discovery dualled in Waubaunsee-Penn gas pay.
4. Oklahoma; Cimarron; S. Griggs	1958	**Council Grove**	3,330	1 gas	First area Council Grove production.
5. Oklahoma; Texas; N.W. Hitchland	1959	**Council Grove**	3,150	1 gas	Thirty-five miles southwest of similar production.
6. Oklahoma; Beaver; Mocane	1955	**Council Grove**	3,100	15 gas	First Council Grove production in Okla.
7. Oklahoma; Beaver; E. Sunnyside	1957	**Council Grove**	3,210	1 gas	
1. Kansas; Meade; Barragree	1959	**Council Grove**	3,100	1 gas	Two offsets were dry.
2. Kansas; Hamilton; Bradshaw	1957	Permian	2,550	1 gas	Dualled as Toronto-Penn discovery.
3. Kansas; Meade; S. Horace	1959	**Council Grove**	3,230	1 gas	Part of world's largest gas field.
4. Kansas-Okla.-Texas; 14 counties; Hugoton	1920	Chase	2,500-3,200	7,000 gas	
5. Kansas; Scott; Keystone	1951	Chase	2,750	1 gas	
6. Kansas; Grant, Stevens, Kearny; Panama	1956	**Council Grove**	2,800	20 gas	Field is combination of 15 scattered finds.
7. Kansas; Hamilton; Medway	1960	Winfield	2,305	1 gas	

Data from National Petroleum Bibliography.

the Texas Panhandle looking for Red Cave production. Phillips Petroleum Co. just announced four such strat tests for Sherman County. Purpose of Phillips' program is to seek out the Red Cave's potential in the northern part of the Panhandle. Red Cave is considered to be productive over an area of about 200,000 acres or more in the southern part of the Panhandle gas field. Phillips will drill 1-A Bivins in Sherman County, 21 miles east of Stratford; 1-A Hunt in Sherman County, 32 miles southeast of Stratford; 1-A Jarmer in Sherman County, 20 miles east of Stratford; and the 1-A Witt "E" inside Hugoton gas field, 6 miles southeast of Stratford.

Colorado Interstate has begun to drill to Red Cave in a 160,000-acre area thought to be productive inside Panhandle gas field in northern Potter County and southern Moore County. The Colorado firm will drill ten strat tests throughout the area. All drilling will be done with mud except for one.

For regional success. The Council Grove, another Permian group, has made exploratory history since 1955 at Mocane in Beaver County, Oklahoma Panhandle, when it became productive for the first time. The Mocane discovery was followed by discoveries at South Griggs in Cimarron County, Northwest Hitchland in Texas County, and East Sunnyside in Beaver County. The Council Grove also moved its success into southwestern Kansas where there are three fields producing gas, one of them the largest such pool in the entire province—Panoma. The Panoma district is comprised of 15 scattered Council Grove finds—all combined last year into one non-continuous producing area, covering parts of Grant, Stevens, and Kearny counties.

And future drilling. The wide expanse of the Hugoton-Panhandle region is the nation's most active oil and gas area. Success ratios are higher here than in any other section of the United States. Its future is one of the brightest in the tea leaves. Some liken the current bustle of Hugoton-Panhandle to the school-age days of the Permian basin of West Texas. Its multitude of pay sands, shallow-intermediate drilling depths, and new outlets for the product, will deem it more than attractive to operators for many years to come. The search for Permian production is just one of the many unwritten chapters in this story.

—John C. McCaslin

New Mexico gets Abo Reef find

IN NEW MEXICO, Sinclair Oil & Gas Co. has completed an Abo Reef discovery at its 65-A Turner "B," SE SW 20-17s-31e, in the Grayburg-Jackson field of Eddy County.

The well flowed at the daily rate of 288 bbl. of 43.1°-gravity oil through a 16/64-in. choke from Abo perforations at 7,120-50 ft.

Other production in Grayburg-Jackson field is from the shallow Seven Rivers and Grayburg-San Andres formations. The well is about 16 miles east of other Abo reef production in Empire field.

Sinclair completed 3 Yates "B," SW NW 33-17s-28e, as a producer in the Empire Abo field of Eddy County. The well was potentialed for a calculated daily flow of 131 bbl. of 43.1°-gravity oil through an 18/64-in. choke from Abo perforations at 6,038-53 and 6,068-73 ft.

Good recovery from New Mexico well

GOOD RECOVERY from a rank wildcat well in Eddy County, New Mexico, has been reported by Pan American Petroleum Corp.

Pan American's 1 Yates - U.S.A. Federal flowed 97 bbl. of oil and no water in 14 hours through a 10/64-in. choke on a completion test of an undesignated section of the Wolfcamp. Oil gravity was 45°, with a gas-oil ratio of 1,345:1.

The Wolfcamp pay was topped at 5,740 ft., and the well was drilled to a total depth of 6,100 ft., plugged back to 5,792. Perforations were 5,740-50 ft.

The well is located in Section 13-19s-25e, about 5 miles southwest of Dayton. There are no other Wolfcamp producers in the general area. Pan Am operates the well and holds interest in 2,600 acres in the area.

North Dakota discovery confirmed

The confirmation to last year's remotely located Rough Rider discovery in McKenzie County, western North Dakota, flowed 255 bbl. of 37.7°-gravity oil per day on 13/64-in. choke. Texaco Inc. completed this confirmation and southeast extension from perforations at 9,436-40 ft. in the Madison Mississippian.

This is the field's second producer. It lies 1 mile southeast of the Shell Oil Co.-Northern Pacific Railroad Co. discovery which made 341 bbl. per day. These operators are now drilling a second well in 16-145n-101w, west of the discovery well. It did not find anything in the Mississippian and is nearing 13,350 ft., objective depth.

Pennsylvania Shallow-well Completions

FIRST QUARTER 1960

County	Total	Oil	Gas	Dry	Service	Footage
Armstrong	17	..	16	1	..	51,867
Clarion	6	..	6	..	..	13,439
Clearfield	1	..	..	1	..	1,298
Elk	1	..	1	..	..	2,756
Indiana	5	..	3	2	..	17,452
Jefferson	2	..	2	..	..	6,523
McKean	123	65	1	1	56	224,218
Venango	1	1	..	..	..	1,131
Warren	2	2	..	..	..	1,844
Washington	3	1	..	1	1	8,143
Westmoreland	14	..	12	2	..	47,309
Total	**175**	**69**	**41**	**8**	**57**	**375,980**

Total footage wells drilled deeper = 1,799 ft.
Total footage of all wells = 377,779 ft.
Armstrong and McKean counties each had 3 wells drilled deeper; Westmoreland had one.

Here are details on Utah test

TESTING CONTINUES at Pure Oil Co.'s important Northwest Lisbon field in the northern Paradox basin, San Juan County, Utah.

The firm is running production tests of Mississippian and Devonian McCracken pays at the 1 USA-B in NE NW 14-30s-24e. This well, 1½ miles southeast of the field discovery well, flowed 841 bbl. of oil and gas at the rate of 500 M.c.f.d. on 36-hour test of the McCracken zone through ½-in. choke from perforations at 8,905-43 and 8,960-98 ft. On a 24-hour test through 35/64-in. choke, flow from the Mississippian was 413 bbl. of condensate and 6,200 M.c.f.d., from perforations between 8,192 and 8,548 ft. Tests continue.

Elliott Production Co. has set casing at 1 Lisbon Valley-C in NE NW 9-30s-24e, a 1-mile west extension of the field discovery well. Pure also is drilling at 8,979 ft. at 1 USA-C in C NE SE 4-30s-24e. This 1-mile northwest extension try flowed more than 7 M.M.c.f.d. during drill-stem tests in the Mississippian.

Southeast Lisbon. About 17 miles southeast on the Lisbon anticline in San Miguel County, Colorado, Pure is running production tests of both Mississippian and Ouray-Devonian.

Rich pay discovered at South Texas well

An important new discovery was reported in San Patricio County, South Texas, at Goldston Oil Corp. 1 J. E. Garrett, 2 miles southwest of Gregory.

The well, downdip equivalent of McKamey sand which is northwest on the eastern edge of Midway field, flowed 6 M.M.c.f.d. from 10,592-10,600 ft. plus 125 bbl. of condensate per million. Location is in the northeastern corner of Section P, George H. Paul Subdivision of Coleman-Fulton Pasture Land, midway between Geronimo and Commonwealth fields. It lies 2 miles east of Stark field.

North Taft. Engeo Oil & Gas Co. 1-B W. L. Roots Estate in the newly opened North Taft area of San Patricio County, 5 miles northeast of Taft, flowed 152 bbl. of oil per day from middle tubing phase at 6,390½-93½ ft. in the D-6 Sand, Segment B. The upper tubing phase at 6,368-72 ft., D-4 sand, Segment B, made 168 bbl. of oil per day. The third zone is yet to be tested for a triple completion success. This new field was opened at Humble Oil & Refining Co. 1 Edness L. Roots. It made 117 bbl. of oil per day from perforations at 6,390-92 ft., opening up North Taft 6,400-ft. Frio field. The new well at Engeo 1-B is the east offset to Humble's find in Section 24, Fourth Addition Taft Farm Lands. The field is across the controlling fault which limits the producing limits of Taft field that is south.

West Texas' Winkler gets Waddell gas discovery

Gas-condensate production was tapped at Texaco Inc. 11 S. M. Halley in Emperor field, central Winkler County. Pay is the Waddell sand.

The well, 4 miles east of Wink, flowed 6,850 M.c.f.d. plus 160 bbl. condensate from perforations at 11,220-38 ft., natural. Regular field pay, the Devonian, was good for 41 M.M.c.f.d. and 34 bbl. condensate from perforations at 9,181-9,328 ft. Well is in Section 7, Block B-11, PSL Survey, 1½ miles northwest of a lone Waddell sand gas-condensate well, the Humble 1 Hogg.

Gulf Coast's Sabine Lake adds second field discovery

FINDING of the second field in Sabine Lake is lending more encouragement to further exploration in this large long-neglected inland body of water on the Gulf Coast.

It comes in the drilling of seven deep tests started in the lake since the first field was opened last August. Only one of these, except the new discovery, has proved successful so far. Recently completed, it confirms the discovery of the lake's first field.

Four of the seven tests have been dry holes. Another still is drilling, now near 13,000 ft.

The new discovery well is being completed as a small dry-gas well from a sand perforated at 11,320-30 ft. Its flow of only 250 M.c.f.d. through 10/64-in. choke from that depth might be considered disappointing. But, it reveals the presence of production and leads the way to further development with possible greater and better productivity.

It is one of two deep tests started by The California Co. about the same time (last February) on a state lease block near the center of the lake. The other, less than 2 miles northeast, has just been abandoned as one of the four dry holes. Both were drilled to depths below 14,000 ft., the producer to 14,094 ft., and the dry hole to 14,005 ft.

Locations of both are on the Louisiana side (in Cameron Parish) of the Texas-Louisiana line that divides the lake lengthwise. At this point the lake is about 9 miles wide with location of the discovery well about 3½ miles offshore from the Louisiana shore.

Calco's discovery is 7 miles south and a little west of the lake's initial field, located in the north part of the lake and officially named North Sabine Lake. There Shell Oil Co. is the operator. Its discovery well was completed in a sand at 11,070-80 ft. with a daily flow through 9/64-in. choke of 141 bbl. of 44.7°-gravity oil with 2,800 M.c.f. of gas.

Shell's second test, 2,000 ft. northeast of the discovery well, was dry at 11,507 ft. The recently completed confirming well, the third test, is 3,700 ft. south of the dry hole and ½ mile southeast of the discovery well. It tested 1,450 M.c.f. of gas and 12 bbl. of 57.8°-gravity oil daily through 20/64-in. choke. Completion is with perforations at 10,892-10,902 ft. in what may be a different sand from that of the discovery well.

GULF Coast's large Sabine Lake attracts new interest with discovery of second field. Humble deep test still drilling.

The current wildcat drilling operation is by Humble Oil & Refining Co. in Tract 8 on the Texas side of the line about 2 miles southwest of Shell's wells.

Dry holes drilled since the first field was opened include a 16,000-ft. test by Shell on Louisiana State Lease 3,464, a little more than 2 miles southeast of Calco's new discovery well, and a 7,989-ft. test by Mecom Petroleum Co. on State Lease 3,462, near the Louisiana shoreline about 3½ miles northeast of the discovery.

Sabine Lake, more than 16 miles long, up to 9 miles wide, and embracing an area of more than 95 sq. miles (more than 500,000 acres), has remained one of the Gulf Coast's largest single, little-explored, inshore expanses. Although in the heart of the coastal salt basin and closely ringed by prolific oil and gas fields, including such old mainstays as Spindletop and Orange, wildcatters for some reason have been slow to move in.

Gulf Coast wildcat hits as dry gas discovery

A Brazos County wildcat, 4 miles southwest of Millican in the Texas Gulf Coast area, flowed 30-40 M.M. c.f.d., estimated, from perforations at 3,412-16 ft. This well is Lonnie Holotik's 2 P. P. Prescott on the Walter Southerland Survey. Nearest production is 3 miles northeast in Millican field.

South Texas. A big gas well is reported in Zapata County, 16 miles east of San Ygnacio on the Los Mogotes Grant.

The well is Amarada Petroleum Corp. 1 Haynes Estate. Production is rated at 30 M.M.c.f.d. from Queen City at 2,822 to 4,067 ft. through seven sets of perforations.

Duval County. Camp Oil Co. 1 T. R. Huizar, a Hockley gas discovery 10 miles west of San Diego off the northwest flank of old Muralla field, flowed 36 M.M.c.f.d., dry. Location is in Section 19, H&GN Survey, A-315.

Kenedy County. Humble Oil & Refining Co. 2 Daniel J. Sullivan IV, 15 miles southeast of Falfurrias, is an oil discovery. The well flowed 52 bbl. of oil per day from perforations

at 8,296-8,306 ft. This well was closed last February as a potential producer. Location is on the San Antonio del Encinal Grant, A-61. Humble requests the field to be set up as East Pita field.

Kleberg County. The May area has its deepest production at J. Ray McDermott & Co. 1 V. A. Hubert in Lot 3, Block 13, Theo. F. Koch Subdivision. Gas-condensate flowed from perforations in the basal Series at 9,798-9,808 ft. Flow was 3,500 M.c.f.d. plus 47.6°-gravity condensate at the ratio of 56,700:1.

Texas confirmation well flows oil in Tannehill

North Peacock field, a recently opened Tannehill sand area in west-central Stonewall County in West Central Texas, was confirmed at Roark, Hooker, and Roark 1 H. R. Metcalf, a north offset to the discovery well, 1 Earl Coplen.

The new well flowed 240 bbl. of oil daily through 20/64-in. choke from perforations in the Tannehill at 3,481-87 ft. and 3,495-99 ft. Location is in Section 295, Block D, H&TC Survey, 2½ miles north of Peacock townsite. The discovery well flowed from perforations at 3,482-92 ft. Nearest Tannehill production is in Mullen Ranch field, 6 miles northeast. Nearest production of any kind is Canyon Reef Carlile field, 2 miles north, Jones County. The third well and southern extension to Horton field was completed in Jones County, 6 miles northwest of Merkel. The well is Fletcher Oil & Gas Drilling Co. 1-D Lilley P. Brown on Subdivision 25, DeWitt County School Land Survey 150. The well flowed 132 bbl. of oil daily on 30/64-in. choke from perforations at 3,635-56 and 3,639-60 ft. Pay is Cisco.

Discovery wells

CALIFORNIA

San Joaquin County:

Great Basins Petroleum Co. 6623 Signet-Whiting, NW SE 23-2s-6e, 3,500 M.c.f.d., 3/4-in. choke, perfs. 5,940-70 ft., TD 6,425 ft. (New gas field discovery 5 miles north of Vernalis field.)

WESTERN CANADA

Alberta:

British-American-Pan American 12-12 Cora Swan Hills, LSD 12, 12-66-1w5. Beaverhill Lake oil discovery. TD 8,770 ft.

KENTUCKY

Larue County:

Burns & Radgewicz 1 Dixie Stock Farms, 11-M-44. IP 260 M.c.f.d., Salem 220-240 ft. TD 838 ft. Gas discovery.

Taylor County:

Bander & Couch 1 City of Abilene, 2 miles southeast of Abilene in Sec. 60, BAL Sur. IPP 28 BOPD, 38°, 1,833-51 ft. New oil discovery.

MICHIGAN

Allegan County:

Michigan Consolidated Gas Co. 1 Fales, NE SW NE 17-3n-11w, Wayland Township, deeper pay in Wayland pool. IP 350 BO 7 hours. Elev. 790 ft., Traverse lime 1,724 ft., Salina A-2 2,953 ft., Salina A-1 3,128 ft., Trenton 3,996 ft., TD 4,400 ft. Perf. 3,132-44 ft. New pay (Salina dolomite).

Calhoun County:

Perry Fulk 1 Rosenau-Trader, NW NE NE 1-4s-4w, Homer Township, 2 miles south Albion pool. IP 500 bbl. 1 hour (prorated to 150 day after test). Elev. 1,048 ft., Trenton 3,846 ft., TD 4,263 ft. Albion pool extension.

Perry Fulk 1 Ripley, NW SE NW 26-1s-5w, Lee Township, 10 miles northwest Albion pool. IP 168 bbl. 19 hours. Elev. 1,046 ft., Trenton 4,233 ft., Black River 4,584 ft. TD 4,910 ft. New pay.

James O. Kelly 1 Dunlap, SE NW SE 22-1s-5w, 10 miles northwest Albion oil field. IP 4,300 M.c.f.d. Elev. 942 ft. Trenton 4,912 ft., dolomite pay 4,230-4,320 ft. TD 4,912 ft. New gas pool.

Hillsdale County:

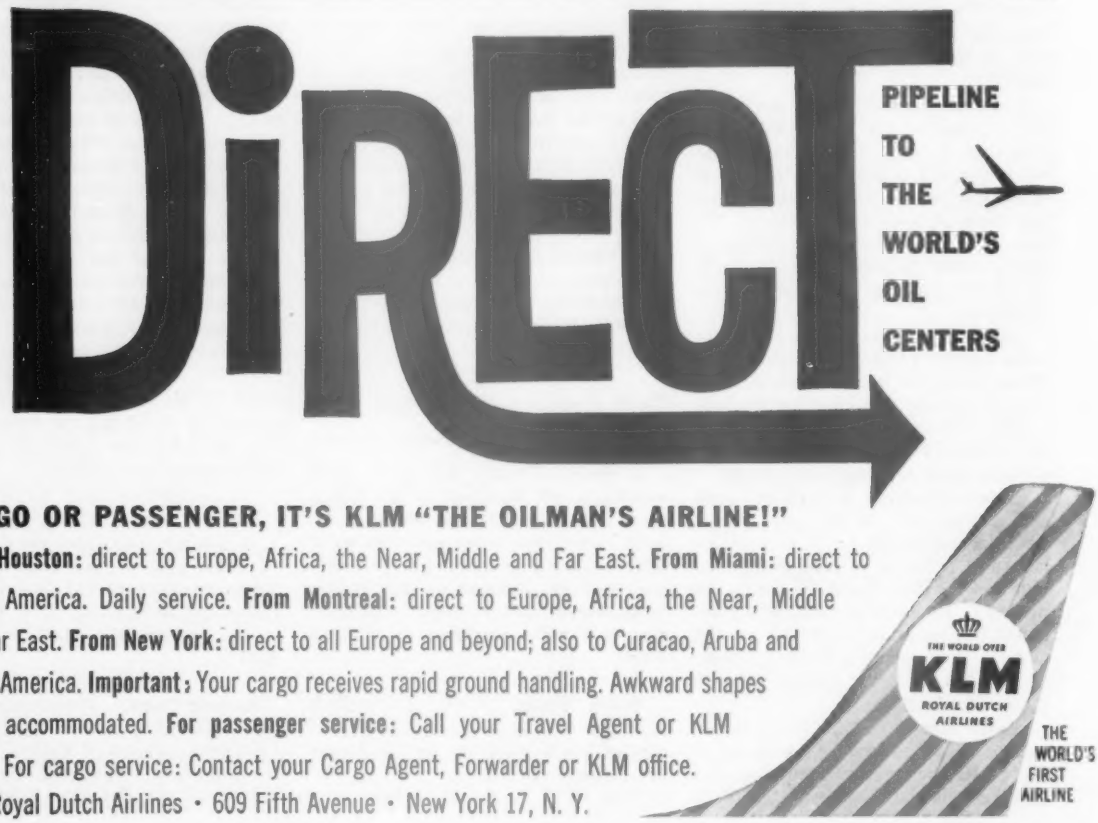
C. J. Simpson 1 Sponseller, NW NW NW 4-6s-2w, 3 miles southeast Scipio oil field. IP 500 BOPD, 24/64th-in. choke Scipio extension.

OHIO

Vinton County:

Ridgedale Oil & Gas Co. Inc. 2 Shurtz, N½ SW¼ Section 14, Swan Township. IPF 6,582 M.c.f.d., natural, Clinton sand discovery. Rock pressure 850 psi. TD?

(Continued on page 196)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Robert F. Bauer . . . challenging gamble pays off.

Drilling Firm Busy Offshore

• Oil is Global Marine's main interest, but some unusual sidelines make job a "fascinating endeavor," Bauer says.

"WE THOUGHT there were real opportunities in the field of floating drilling rigs, and by reason of our past experience, we felt we were well qualified in the field. So we chose to gamble our future on independence."

That, in a nutshell, is how Robert F. Bauer characterizes the formation of Global Marine Exploration Co., Los Angeles, which he heads as president.

Global Marine was incorporated by the personnel of the CUSS Group (Continental, Union, Shell, and Superior) when that cooperative offshore venture was dissolved in 1958. The CUSS companies agreed to let Bauer and his associates establish themselves as an independent contractor and sold them the CUSS Group's floating equipment.

"When we started, our fears were largely twofold: We were offering a unique service, so we were doubtful that we could survive the period required to have this type of service accepted by the industry.

"Our other fear was whether any of us engineers had the business talents necessary to function independently.

"In our short life, we've found our experience and know-how in offshore drilling has application to problems in many fields," Bauer adds in something of an understatement. "It has led to some unique opportunities."

Here are some of these:

. . . **The Moho project.** Global Marine has made studies for the National Academy of Sciences on its plan to drill through the earth's crust to the Mohorovicic Discontinuity.

. . . **Underwater storage.** Global Marine, Firestone Tire & Rubber Co., and Jet Fuel & Storage Co. are working on a plan for storing fuel in collapsible tanks anchored to the ocean floor (OGJ Newsletter, Apr. 25).

. . . **Ocean-floor mining.** Global Marine has done preliminary studies for others on the feasibility of conducting ocean-floor mining operations, using techniques developed in their floating drilling operations.

. . . **Tunneling.** The company has been called in as consultants by firms studying ways of tunneling for long distances beneath the ocean floor. Such consultations have included the current plan for tunneling between England and France, for instance. Global Marine has also been consulted on location of bridge supports.

. . . **Underwater television.** Its development and use of underwater TV techniques in its drilling operations have led to some unusual projects, including the locating and identification of sunken ships.

. . . **National defense.** Its experience has resulted in contracts with the Navy on a variety of defense matters.

Despite this varied list of projects, Bauer and his staff's primary interest is in the offshore drilling business.

Roughnecked early . . . Bauer was roughnecking in California oil fields before he was even out of high school.

He was born in Declo, Idaho, January 10, 1918. Bauer says he acquired his grammer school education in Rocky Mountain schools—his way of indicating the Bauer family did a lot of moving around.

While residing in Colorado, a favorite uncle in California lured him westward with a job offer.

He worked his way through the University of Southern California by roughnecking in neighboring oil fields. His USC studies were interrupted for a brief spell when he was enticed away by the University of Utah to do a bit of footballing.

He returned to USC for his senior year and carried 21 units in the engineering school while pushing tools full time. His determination led to a BS in petroleum engineering in 1942.

He joined Union Oil Co. of California upon graduation and was assigned to the manufacturing department as a trainee. He was soon transferred to research work in drilling and production. In this assignment he did a lot of work on methods for extracting bitumen from bituminous sands and on methods for producing California's heavy crudes.

Bauer first got his feet wet in offshore oil problems when he was assigned to help design and build a diving bell for gravimetric work in the Gulf of Mexico.

After his stint in research, he served as production foreman and district superintendent before being called to work on company-wide production problems. In 1954 he was assigned to the CUSS group.

During Bauer's tenure with CUSS, extensive experiments with drilling from a floating vessel were conducted and the well-known CUSS I was built incorporating many revolutionary techniques in the field. The CUSS I was used in an extensive coring program of California's submerged lands before it was decided to break up the group in 1958.

Bauer speaks of drilling from floating vessels as "challenging," "the method of the future," and a "fascinating endeavor," all of which reflect his intense interest in his niche in the oil business.

(An article on Global Marine's underwater completion methods appears on page 116.)

Sinclair Oil Corp. Receives Conservation Award

P. C. Spencer, right, chairman of Sinclair Oil Corp., accepts the Department of Interior's conservation service award from Fred A. Seaton, secretary of the interior. The award cited Sinclair for contributions to conservation through a series of public-service advertisements. Sinclair was commended for "consistent, effective efforts to interpret and popularize the methods and achievements of conservation." The ad series began in 1955.

D. E. Stines, vice president and a director of Creole Petroleum Corp., has been appointed executive assistant to **Leo D. Welch,** chairman of Standard Oil Co. (N. J.). Stines has been with the Jersey companies since 1929. He had been head of the coordination division of Jersey's coordination and economics department, vice chairman of the coordination committee for Europe, and special adviser on refining to Esso Petroleum Co., Ltd., before being assigned to Creole in 1956.

E. H. Scott, supervisor in the automotive engineering division of Standard Oil Co. (Ohio), operations and planning section, has been named project engineer, construction section, in the general engineering division. **Robert C. Tupa,** supervisor of the lube section, automotive engineering division, has succeeded Scott. **Walter R. Tuuri,** group engineer in the lube section, has replaced Tupa.

L. A. Bullington and **B. S. Greenwood** have been promoted to senior supervising engineers in the technical division of Humble Oil & Refining Co.'s Baytown, Tex., refinery. Bullington will head the economic analysis section, Greenwood, the butyl and butadiene section. **E. W. Biggers** has been promoted to assistant foreman of the distillation department in Baytown.

Stephen G. Abbott, manager, engineering field, at Shell Oil Co.'s Wilmington, Calif., refinery, has been named manager, engineering services, there. He succeeds **L. Claire Austill,** who has taken over Abbott's former post. **Thomas M. Carmody,** technologist, alkylation, at Wilmington, has been promoted to assistant manager of thermal cracking. **Richard A. O'Hare,** assistant manager of the refinery laboratory, will be transferred to Shell's head office this month as a senior technologist in manufacturing operations.

Trajan Nitescu and **Donald S. Harvie** have been elected directors of Canadian Petrofina, Ltd. Nitescu is president of Calvan Consolidated Oil & Gas Co., Ltd., president of Canadian Fina Oil, Ltd., and chairman of Western Leaseholds, Ltd., affiliates of Canadian Petrofina. Harvie is president and a director of Western Leaseholds, a director and general manager of Canadian Fina, and a director of Calvan.

Thomas D. Higgins, Jr., manager of retail sales in Sun Oil Co.'s Ohio Valley region, has been named assistant manager of the central sales region, Pittsburgh. Higgins succeeds **Emory M. Osgood,** who recently was named manager of the Ohio Valley sales region. **Francis F. Palmer,** general manager of Sun's industrial products department, will succeed Higgins in Cincinnati.

Charles C. Whittelsey, president of Ford, Bacon & Davis, Inc., received an honorary doctor of engineering degree at commencement exercises of Missouri School of Mines, Rolla, last week. Whittelsey is an alumnus of the school.

Aden P. Williams, Jr., vice president and a director of Penola Oil Co., a Standard Oil Co. (N. J.) subsidiary, has been named reseller sales manager for Humble Oil & Refining Co.'s Esso Standard division. He succeeds **Harold T. Cruickshank,** recently named manager of marketing development for Jersey Standard.

William R. Horkey, head of the legal department of Helmerich & Payne, Inc., a director and member of the company's executive committee, has been elected vice president and general counsel.

H. G. Whittle and **C. L. Harris,** shift supervisors for Shell Chemical Corp., has been named operating assistants at the company's Torrance, Calif., plant. **F. H. Barlow** and **Bernard Chesler,** shift foremen, have been named shift supervisors.

Russell D. Richardson, financial vice president of Tidewater Oil Co. since 1958, has retired after 39 years with the company.

W. A. (Gus) Delaney, Jr., Ada, Okla., independent, has resigned as president of Independent Producers and Royalty Owners Association of Oklahoma. Delaney was a leader in formation of the group. **T. Elwood Kemp,** Ada attorney and oil operator, is expected to take over as president. Kemp is now senior vice president of the association.

David B. Morrison, Denver consulting engineer, has joined Frontier Refining Co. in Denver. **Ivan Alspaw,** petroleum engineer with Standard Oil Co. of Texas in Kermit, Tex., has joined Frontier in McCook, Neb. **R. J. Funk** has left Frontier to join Circulation Control, Inc., in Denver as petroleum engineer.

William Muly has been named an engineering associate for Esso Research & Engineering Co. Muly is currently on assignment as head of a technical advisory group working with startup of the new Esso refinery in Rotterdam.

Sam F. Shakely has been named to the new position of manager of production for Anderson - Prichard Oil Corp. He had been general superintendent. Shakely joined Apco in 1948 after 11 years with Humble Oil & Refining Co.'s Carter division.

R. B. Fleske, superintendent of gas measurement for Cities Service Gas Co. in Oklahoma City, will head next year's Southwestern Gas Measurement short course at the University of Oklahoma, Norman, as general superintendent. **R. R. McCafferty,** general pipeline superintendent for Pioneer Natural Gas Co., was general chairman of the 1960 course.

Paul Miles, evaluation engineer with Interstate Oil Pipe Line Co., has been given a 2-year assignment with Standard Oil Co. (N. J.) in New York. He will be in the transportation-coordination department.

Floyd T. Stevenson, measurement engineer with Transcontinental Gas Pipe Line Corp., has been transferred to Grover, N. C., from Thibodaux, La.

O. J. Swingle, operating manager of Mobil Oil Co.'s New York City division, has been named manager of distribution in the supply and distribution department. He succeeds **Clarence W. Dole,** who will retire July 1 after 37 years with the company.

Dick T. Fenwick, assistant manager of Sinclair Oil & Gas Co.'s Denver division, has been named assistant to **L. G. Rheinberger,** vice president in charge of the gas and gas products department, Tulsa. **C. H. McClure,** assistant manager of the Tulsa division, will be transferred to Denver to succeed Fenwick.

Gerald N. Eason and **Harry G. Hadler** have formed Hadson Oil & Gas Co. in Oklahoma City. Eason, formerly vice president of Fain-Porter Drilling Corp., will be president of the new company. Hadler, who had been Fain-Porter's chief geologist, will be vice president and manager of exploration.

Richard Bagge has been named head of the new systems engineering section in the Lima, Ohio, refinery of Standard Oil Co. (Ohio). **Ralph Johnson,** senior engineer, has succeeded Bagge as group leader in process engineering. **William Shock,** senior engineer, has been named head of the new design and service engineering section.

William H. Starr has joined Great Northern Oil Co. as assistant wholesale sales manager. He will headquarter in St. Paul, Minn.

George L. Hancock, Jr., senior petroleum engineer with Gulf Oil Corp., has been transferred to New Orleans from Oklahoma City. **F. M. Caylor,** petroleum engineer with Gulf, has been transferred to Oklahoma City from Evansville, Ind.

S. J. Talley, southwest regional exploration geologist for Phillips Petroleum Co. in Bartlesville, Okla., has been transferred to Midland, Tex., as assistant division manager and division exploration geologist. **R. A. Wolgast,** district land man in Durango, Colo., has been named division land man in Denver.

Bruce L. Ritz, administrative assistant in research and engineering for Sun Oil Co., has been named administrative manager of the research and engineering department. He succeeds **J. Harold Perrine,** who has been named assistant director of industrial relations for Sun.

E. W. Dissler, vice president and manager of Canada-Cities Service Petroleum Corp. and vice president of Cities Service Athabasca, Inc., has been appointed manager of exploration for Cities Service Oil Co. He succeeds **Reese H. Tucker,** who recently was elected vice president of Cities Service Co., the parent company. **C. E. Cole,** exploration manager of Arkansas Fuel Oil Corp. in Shreveport, La., will succeed Dissler as exploration manager of Canada-Cities Service. Also **James W. McColl,** superintendent of the land department of Cities Service Oil, has been named to head a new group which will work with acquisition of new properties. **Barron Housel,** Mid-Continent exploration manager for the exploration division will succeed McColl.

DISSLER

Charles B. Morgan has resigned as manager of exploration for Petroleum Exploration, Inc., of Texas, to open geological consulting offices in Amarillo, Tex.

Edward J. Cogan, retail sales manager in Syracuse, N. Y., for California Oil Co., has joined Delhi-Taylor Oil Corp. as northeastern regional sales manager. He will headquarter in Syracuse. **Bob Bucher,** technical sales representative for Skelly Oil Co. in Kansas City, has joined Delhi-Taylor as midwestern regional sales manager of the chemical division. He will headquarter in Dallas.

▶▶▶ Personals

W. E. Buck, division engineer for Shell Oil Co. in Wichita Falls, Tex., has been promoted to division superintendent in Abilene, Tex.

LEATH

Louis W. Leath, vice president of Sinclair Oil Corp., has been elected president of Sinclair & BP Sales, Inc. He succeeds **Carl G. Drescher,** president of the company since it was organized last year. Drescher is returning to Sinclair Oil Corp. as vice president.

Robert M. Clawson, mechanical engineer with Shell Oil Co., has been transferred to Abilene, Tex., from Wichita Falls, Tex.

Richard O. Dimit, production engineer with Husky Oil Co. in Cody, Wyo., has joined Arrowhead Exploration Co. in Denver as production engineer.

E. C. Masdon, assistant to the chief development geologist of Standard Oil Co. of Texas in Houston, has been named division development geologist for the western production division in Midland, Tex.

John Knudsen, Jr., general manager and a director of Kent Petroleum Corp., has been elected president of the company. Knudsen was a consultant before joining Kent. He had been vice president and manager of exploration for Federal Oil Corp. before becoming a consultant.

William W. Sanders has been named a group leader at the Whiting, Ind., research laboratories of Standard Oil Co. (Ind.). He will work with evaluation of petroleum refining processes.

Dr. E. Singer has been appointed a development supervisor in Shell Development Co.'s Emeryville, Calif., research center. He will direct application of machine programing methods to process design and evaluation.

Personals

George Staples, assistant to the production vice president of Champlin Oil & Refining Co., has been promoted to manager of drilling and production. Staples joined Champlin in 1943 as a gas engineer. He had served as gas production superintendent, general superintendent of the gas production department, and Gulf Coast division superintendent, production department, before his appointment as assistant to the production vice president in 1956.

Ronald E. Vassau, junior resident engineer for Mobil Oil Co. in Los Angeles, has been named exploration geologist in Santa Fe Springs, Calif.

George B. Pichel, offshore district geologist in Houston for Union Oil Co., has been transferred to Los Angeles as foreign exploration coordinator.

Harvey E. Phelps has been named manager of mechanical design and construction for Goodrich-Gulf Chemicals, Inc. He will be responsible for design and construction of new manufacturing facilities of the company.

F. H. Moore, assistant chief design engineer for Texaco Inc., has been transferred to Houston from New York.

W. B. Avery, project engineer for Texaco Inc., is being transferred to Houston from New York.

Anthony Amante, Texas Instruments, Inc., has been appointed export sales manager for the geosciences and instrumentation division's instrumentation product group in Houston. He will be responsible for foreign marketing of all instrumentation and control systems designed and manufactured by this group.

E. F. Lain, tool pusher with Signal Drilling & Exploration, Inc., has been transferred to Baker, Mont., from Buffalo, S. D.

E. L. (Woody) Hiatt, vice president in charge of transportation and supply for Union Oil Co., has been named head of Glacier division activities for the company. The division covers Montana. Hiatt will headquarter in Great Falls.

Harry W. Magee, manager of the manufacturing department of Gulf Eastern Co. in London, has been named special representative, European activities for Gulf Oil Corp.'s petrochemical department. He will headquarter in London.

E. A. Davenport, Billings, Mont., division production manager for Shell Oil Co., is now on special assignment handling conservation matters for Shell in the Rocky Mountain states. **J. M. Garlick** has been transferred to Billings from Wichita Falls, Tex., to succeed Davenport.

Odie M. Holmes, senior geophysicist and supervisor for Exploration Surveys, Inc., has opened offices as consulting geophysicist in Dallas.

Frank W. Moran, Jr., petroleum engineer with Gulf Oil Corp. in Fort Worth, has been transferred to Roswell, N. M.

Joseph R. Dunbar, production engineer for Ohio Oil Co., has been transferred to Cody, Wyo., from Sidney, Neb.

Eugene Livingston, T. A. Boker, and **Robert Robbie** of Atlantic Refining Co., have been transferred to Las Palmas in the Canary Islands on an exploration assignment in the Spanish Sahara.

Blake B. Schiff, economics engineer with Signal Oil & Gas Co., has been transferred to Los Angeles from Houston. Schiff was economic engineer with Eastern States Petroleum & Chemical Corp. before its merger with Signal.

Andrew J. Rowe, Jr., senior geologist for Sinclair Oil & Gas Co., has been transferred to Oklahoma City from Houston.

Dewey Mark, general sales manager of Vickers Petroleum Co.'s chemical division, has joined Tennessee Oil Refining Co., a division of Tennessee Gas Transmission Co., as manager of petrochemical sales. He will headquarter in Houston. Mark was with Cosden Petroleum Corp. as chemical sales manager before joining Vickers. Tennessee Oil Refining plans to enter the petrochemical field with construction of a 2,000 bbl. per day aromatic solvent unit at its Chalmette, La., refinery. Construction is scheduled to begin soon.

Randel Q. Little, Jr., has been appointed group leader at the Whiting, Ind., research laboratories of Standard Oil Co. (Ind.).

James V. O'Leary, general sales manager of Commercial Solvents Corp., has been elected president of Northwest Nitro-Chemicals, Ltd., an affiliate. **Tom B. Potter,** Northwest sales manager, has been named executive vice president.

Gordon E. Batley, manager of direct sales in the Pacific division of British American Oil Co., Ltd., has been named sales representative, sulfur, for the company. He will headquarter in Toronto.

Deaths

A. E. Reece, 35, geologist with J. C. Sproule & Associates, Calgary consulting firm, died in the crash landing of his light plane in Canada's Arctic area recently. Reece was on a special northern survey at the time.

Samuel D. Hunter, 67, president of Hunter Co., Inc., Shreveport, La., died May 16 in Shreveport. Hunter had been active in the oil industry since 1913.

J. F. Trevitt, 62, secretary-treasurer of General Crude Oil Co. in Houston, died May 28 at his home in Houston.

W. P. Kelly, Sr., manager of the Port Neches, Tex., plant of Texas-U. S. Chemical Co., died recently at his home in Port Arthur, Tex., after a heart attack.

Herman E. Teale, 52, employe relations advisor for Gulf Oil Corp. in Houston, died May 31 in a Houston hospital of cancer. Teale moved to Houston from Tulsa 2 years ago. He had been with Gulf 35 years.

Ernest L. (Tiny) Garton, 56, analyst for the U. S. Bureau of Mines in Bartlesville, Okla., died May 31 in Bartlesville hospital after a heart attack. Garton was with Continental Oil Co. before joining the bureau in 1929.

Outsize June stock gains will soften markets

BY JOHN C. CASPER

REFINERS keep right on running crude in June with little regard for changes in demand for the products they make. This lack of flexibility in the refining program adds to product stocks at an alarming rate during the early summer months. In turn, these rapid increases in product inventories put pressure on product prices.

Take a look at the top two charts. The bars on the first chart represent June refinery runs compared with average runs for the year. Note that June runs never dropped below 99% of the year's average.

But June demand for products ranged from less than 90% of the year's average in 1957 to 96% in 1959.

The fact that June runs are always high in relation to demand assures a gain in product stocks during that month each year.

Over the last 6 years June increases in product stocks have ranged from a low of 6.4 million barrels to 21.9 million. This much variation could mean the difference between a reasonably stable market and a price reduction.

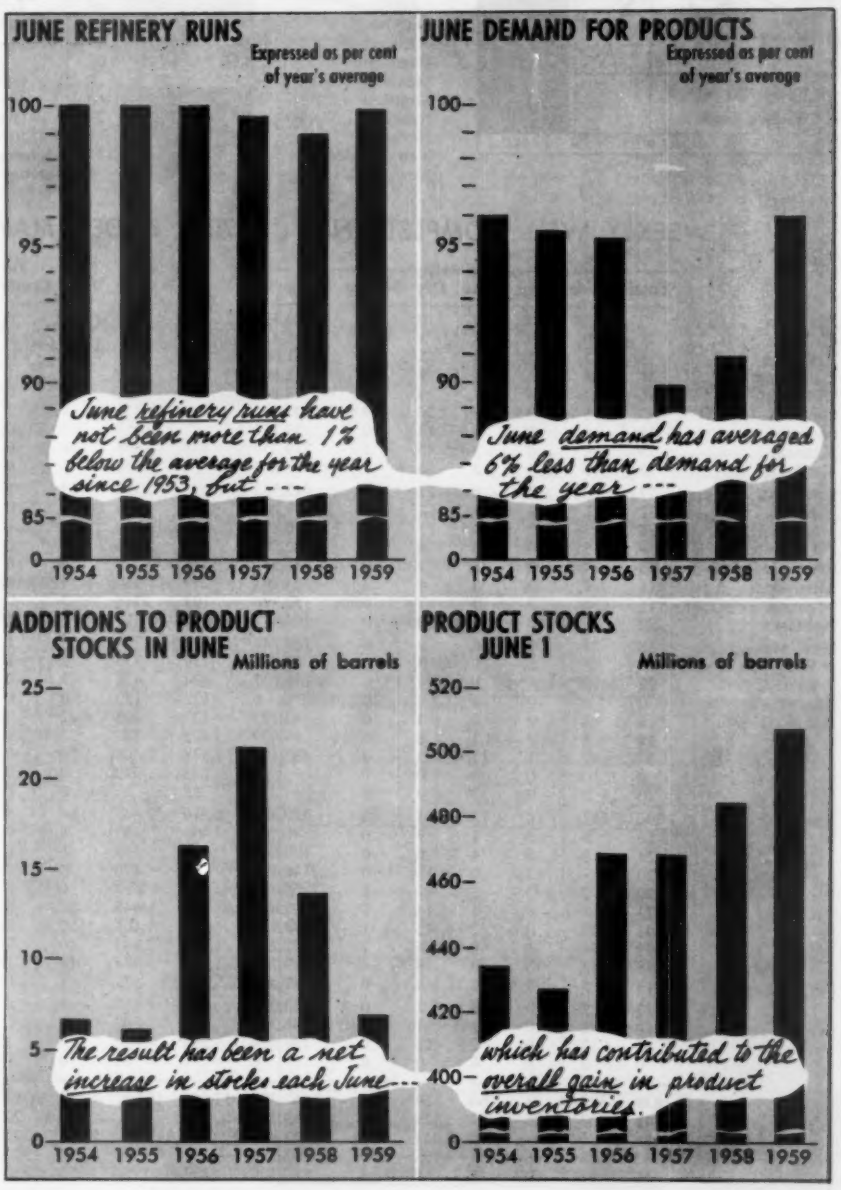
Refiners and marketers should be very cautious in making stock comparisons over the next 3 weeks. The API report for May 20 showed gasoline stocks up 10.5 million barrels from last year. This surplus will shrink over the next 3 weeks, not so much because of a reduction in runs this year but because of very high runs at this time last year.

Gasoline stocks decreased only 3 million barrels last year between May 22 and June 19. They could drop twice that much this year and still be less than average.

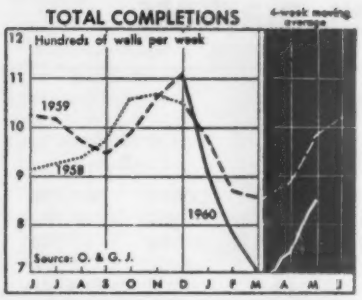
Four-product stocks increased 7.4 million barrels during the week ended June 5 last year. Don't forget this gain when you make year-to-year stock comparisons next week.

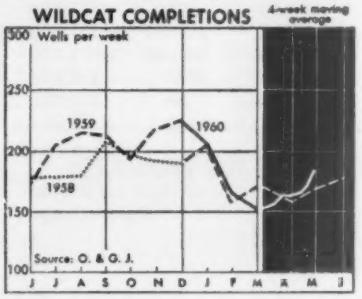
A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,817,550	DOWN	48,760	DOWN	387,220
Crude stocks	260,513,000	UP	685,000	DOWN	1,767,000
Completions	839	DOWN	2	DOWN	206
Refinery runs	7,899,000	DOWN	36,000	UP	11,000
Gasoline stocks	211,653,000	DOWN	2,475,000	UP	8,513,000
Kerosine stocks	24,421,000	UP	1,499,000	UP	391,000
Distillate stocks	91,453,000	UP	3,481,000	DOWN	6,091,000
Residual stocks	39,997,000	UP	1,122,000	DOWN	14,672,000
Four-product stocks	367,524,000	UP	3,627,000	DOWN	11,859,000
Total imports	1,573,100	DOWN	149,500	UP	215,900



DRILLING





Active Rotary Rigs

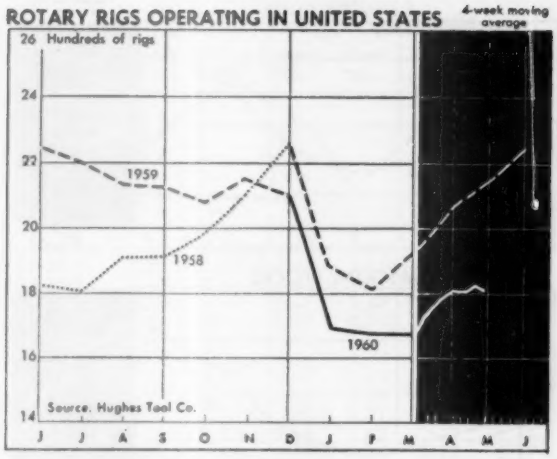
	5-30-60	5-23-60	6-1-59
Alabama	2	5	7
Alaska	5	5	(†)
Arkansas	11	11	16
Arizona	1	2	2
California	92	100	103
Land	88	94	98
Offshore	4	6	5
Colorado	29	28	44
Florida	1	1	3
Land	1	1	2
Offshore	0	0	1
Illinois	43	52	35
Indiana	9	8	4
Iowa	0	0	3
Kansas	128	138	132
Kentucky	5	5	6
Louisiana	285	288	368
North	36	41	36
S. Inland waters	109	113	149
S. Land	85	80	123
Offshore	55	54	60
Maryland	0	0	0
Michigan	39	42	26
Mississippi	52	64	62
Missouri	3	3	1
Montana	21	20	16
Nebraska	27	24	29
Nevada	0	0	1
New Mexico	121	119	131
New York	1	1	1
North Dakota	16	20	31
Ohio	6	5	2
Oklahoma	176	193	239
Oregon	1	1	0
Pennsylvania	11	10	11
South Dakota	1	1	1
Texas	626	655	773
S. Inland waters	6	7	6
S. Land	172	177	180
Offshore	1	1	0
North	48	44	158
Panhandle	48	52	(*)
East	54	62	(*)
West Central	190	199	265
West	107	113	164
Utah	32	31	29
Washington	0	0	0
West Virginia	4	4	6
Wyoming	59	59	84
Total U. S.	1,807	1,895	2,166
Western Canada	123	129	148
Eastern Canada	2	2	0
Grand total	1,932	2,026	2,314

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported April 4, 1960.

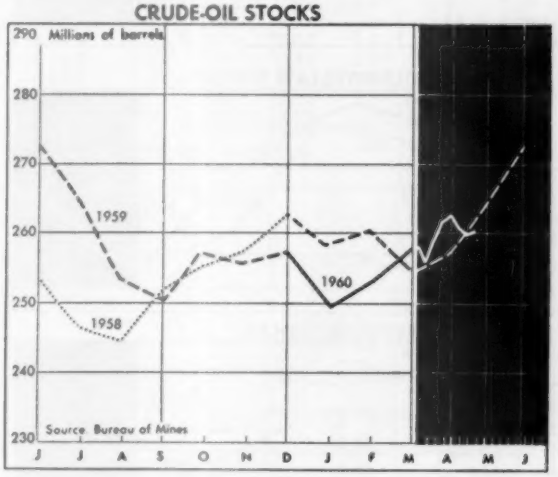
WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 28, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	2	2	0	0	0	0	23,123	22	43	0	0	0	0	0	1	7
Arizona	1	0	0	0	1	0	6,419	7	.....	1	0	0	0	1	7	.....
Arkansas	6	3	0	0	3	0	21,040	245	341	0	0	0	0	0	60	57
California	35	26	0	1	8	0	148,800	543	619	8	1	0	1	6	121	141
Colorado	6	1	0	2	3	0	28,844	264	291	3	0	0	1	2	126	172
Illinois	47	18	0	0	20	9	105,982	780	856	9	1	0	0	8	192	145
Indiana	19	6	0	0	13	0	23,151	365	288	7	0	0	0	7	146	97
Kansas	78	31	0	3	43	1	279,258	1,308	1,668	36	6	0	0	30	437	368
Kentucky	23	6	0	0	16	1	28,264	654	775	2	0	0	0	2	77	67
Louisiana	77	39	2	6	29	1	612,583	1,351	1,435	12	1	0	3	8	196	185
North	32	17	0	3	12	0	113,248	436	509	7	0	0	0	7	83	79
South	36	7	2	3	13	1	396,833	692	770	5	1	0	3	1	100	100
Offshore	9	5	0	0	4	0	102,502	223	156	0	0	0	0	0	13	6
Michigan	13	4	0	8	1	0	43,885	295	239	4	0	0	0	4	91	56
Mississippi	11	7	0	0	4	0	123,295	299	260	4	0	0	0	4	95	118
Montana	11	4	0	0	7	0	52,996	103	115	7	0	0	0	7	47	41
Nebraska	20	10	0	0	10	0	104,471	327	322	5	1	0	0	4	124	148
New Mexico	38	21	2	6	9	0	189,743	733	754	8	1	0	0	7	107	84
West	9	3	1	5	0	0	40,616	239	333	1	1	0	0	0	22	25
East	29	18	1	1	9	0	149,127	494	421	7	0	0	0	7	85	59
New York	0	0	0	0	0	0	0	122	122	0	0	0	0	0	7	12
North Dakota	8	4	0	0	4	0	43,127	127	201	2	0	0	0	2	26	41
Ohio	18	8	0	2	8	0	30,439	428	382	3	0	0	0	3	24	9
Oklahoma	97	47	1	12	33	4	402,199	1,578	2,405	19	0	0	3	16	303	369
Pennsylvania	0	0	0	0	0	0	0	246	212	0	0	0	0	0	7	3
South Dakota	0	0	0	0	0	0	0	15	.....	0	0	0	0	0	6	.....
Texas	290	152	16	13	101	8	1,229,349	6,510	7,845	66	5	2	1	58	1,314	1,460
Dist. 1	16	6	0	1	9	0	46,146	453	467	8	0	0	0	8	155	124
Dist. 2	24	8	6	4	6	0	170,645	308	335	5	0	1	0	4	73	90
Dist. 3	20	7	2	0	11	0	146,179	502	470	4	0	1	0	3	94	104
Dist. 4	20	2	2	3	12	1	65,319	472	514	6	0	0	0	6	133	134
East	23	8	0	1	14	0	97,681	494	448	10	0	0	0	10	105	93
Dist. 7-B	41	26	0	2	12	1	99,953	948	1,108	12	2	0	1	9	266	295
West	75	56	1	0	16	2	372,236	1,717	2,444	10	2	0	0	8	285	299
Dist. 9	56	34	0	0	18	4	149,778	1,213	1,488	10	1	0	0	9	175	272
Dist. 10	15	5	5	2	3	0	81,412	403	571	1	0	0	0	1	28	49
Utah	3	1	0	0	2	0	22,025	117	150	1	0	0	0	1	42	41
West Virginia	14	2	0	11	1	0	46,308	312	302	1	0	0	1	0	4	9
Wyoming	22	7	0	2	13	0	100,054	394	326	13	1	0	0	12	166	107
Miscellaneous	0	0	0	0	0	0	0	41	31	0	0	0	0	0	39	22
Total U. S.	839	399	21	66	329	24	3,665,355	17,186	19,982	211	17	2	10	182	3,765	3,759
Prev. week	841	407	25	62	329	18	3,599,233	.....	.....	181	22	3	7	149	.....	.....
Cum. 1960	17,186	8,096	544	1,410	6,643	493	75,451,807	.....	.....	3,765	342	41	126	3,256	.....	.....
Cum. 1959	19,982	10,123	506	1,453	7,365	535	83,453,534	.....	.....	3,759	382	53	116	3,208	.....	.....
Western Canada	16	11	0	1	4	0	67,308	872	960	2	0	0	0	2	261	342

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	5-21-60	5-14-60	5-23-59
Pennsylvania	2,178	2,171	2,455
Other Appalachian	1,675	1,632	1,706
Illinois, Indiana, Michigan	9,643	9,774	9,036
Nebraska and North Dakota	2,686	2,850	2,689
Kansas	10,224	10,207	10,100
Oklahoma	17,836	17,607	16,868
Arkansas	1,943	2,089	1,765
Louisiana	19,265	19,694	19,388
North	3,398	3,443	3,367
South	15,867	16,251	16,021
Mississippi, Alabama, Florida	2,243	2,351	2,265
New Mexico	7,657	7,284	8,088
Texas	111,606	110,785	114,103
East Texas	9,033	9,104	9,532
West Texas	50,854	50,720	54,089
Texas Gulf	19,301	20,090	18,691
Other Texas	32,418	30,871	31,791
Wyoming	18,122	18,076	16,036
Other Rocky Mountain	9,701	9,458	9,214
California	28,702	27,755	32,214
Foreign	†17,032	18,095	16,353
Total	**260,513**	259,828	262,280

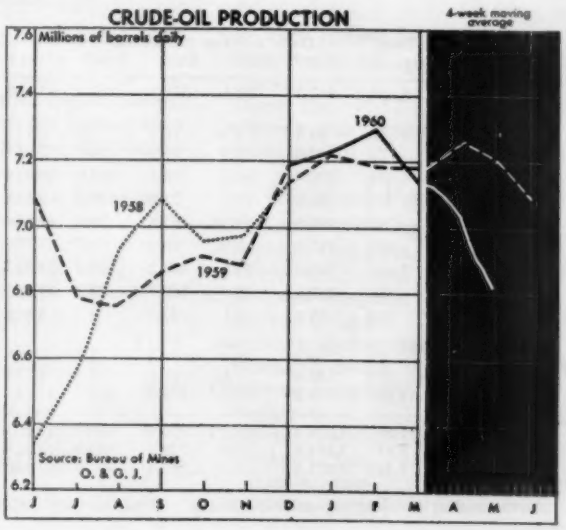
*Bureau of Mines. †Includes 4,276,000 bbl. in California.

DAILY AVERAGE PRODUCTION FOR WEEK

	May 28, 1960 — Crude oil	Lease condensate	Total	May 21 total
Alabama	17,825	.....	17,825	18,850
Arkansas	77,025	100	77,125	82,750
California	828,200	.....	828,200	827,900
Colorado	130,000	.....	130,000	129,700
Eastern	39,800	.....	39,800	40,000
Florida	1,000	.....	1,000	1,000
Illinois	210,700	.....	210,700	210,600
Indiana	31,800	.....	31,800	32,400
Kansas	†308,650	.....	†308,650	†322,860
Kentucky	62,800	.....	62,800	62,300
Louisiana	917,100	134,600	1,051,700	1,051,000
North	107,100	6,100	113,200	112,500
South	810,000	128,500	938,500	938,500
Michigan	32,900	.....	32,900	33,700
Mississippi	137,000	3,600	140,600	140,600
Montana	77,000	.....	77,000	78,000
Nebraska	60,700	.....	60,700	61,000
Nevada	100	.....	100	100
New Mexico	293,000	7,000	300,000	300,000
North Dakota	60,700	.....	60,700	59,200
Oklahoma	†509,600	.....	†509,600	†538,200
Texas	2,326,000	89,900	2,415,900	2,415,900
Dist. 1	40,000	3,000	43,000	43,000
Dist. 2	98,000	8,000	106,000	106,000
Dist. 3	306,000	39,000	345,000	345,000
Dist. 4	159,000	18,000	177,000	177,000
Dist. 5	26,000	400	26,400	26,400
Dist. 6	98,000	9,800	107,800	107,800
East Texas field	120,000	.....	120,000	120,000
Dist. 7-B	121,000	175	121,175	121,175
Dist. 7-C	114,000	2,825	116,825	116,825
Dist. 8	944,000	6,000	950,000	950,000
Dist. 9	193,000	1,700	194,700	194,700
Dist. 10	107,000	1,000	108,000	108,000
Utah	119,400	.....	119,400	120,000
Wyoming	340,000	.....	340,000	339,000
Others	‡1,050	.....	‡1,050	‡1,250
Total U. S.	6,582,350	235,200	**6,817,550**	6,866,310
Change from previous week, down			**48,700**	
Canada	†586,400	.....	†586,400	†585,200
Total U. S. prod.—Jan. 1-May 28			1,057,647,000 bbl.	
Same period last year (crude plus cond.)			*1,068,213,900 bbl.	

*Includes 28,480,590 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

CRUDE-OIL PRODUCTION



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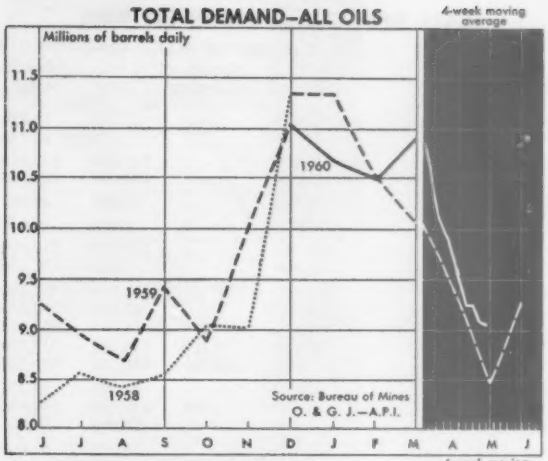

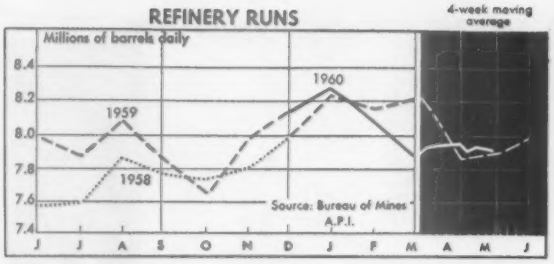

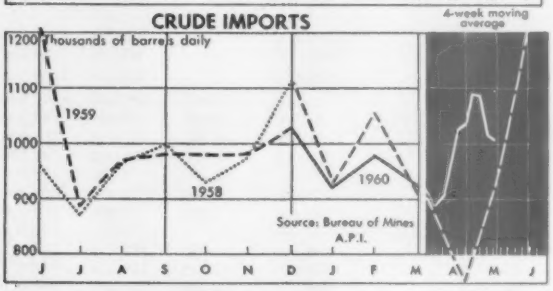

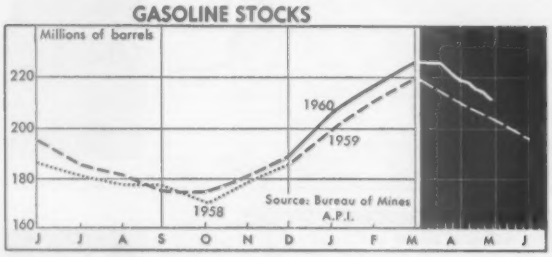

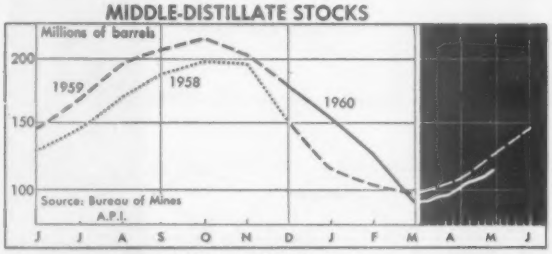

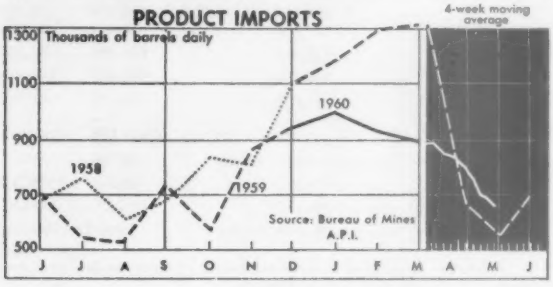

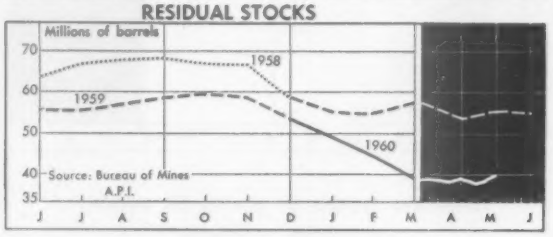

API REFINERY REPORT—MAY 27, 1960
(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,156	542.3	38.1	329.1	177.7	47,009	9,087	30,141	10,841	1,014	437.8	19.7	300.4	144.5
Appalachian:														
District 1 ..	96	38.3	4.3	16.7	7.0	6,185	504	2,083	337	89	40.0	3.2	17.4	9.9
District 2 ..	74	42.6	1.9	15.1	4.3	2,959	254	982	316	87	50.2	5.7	15.6	10.5
Ind., Ill., Ky..	1,408	730.4	66.3	296.1	143.0	39,458	4,765	15,643	4,412	1,437	743.8	60.9	272.7	156.8
Minn., Wis., Dak.	127	62.0	10.1	23.9	17.4	6,615	764	3,212	643	103	48.4	4.5	23.7	13.1
Okla., Kans., Mo.	734	399.3	16.3	163.6	23.6	19,676	1,085	7,805	956	713	396.1	8.7	169.4	18.6
Inland Texas ..	289	187.3	9.9	39.4	16.6	7,194	586	1,449	2,421	283	204.1	8.2	49.7	20.3
Tex. Gulf Coast	1,840	941.0	93.5	447.2	145.6	24,723	3,143	10,713	4,606	1,991	994.0	77.6	478.2	167.6
La. Gulf Coast.	668	367.1	44.0	166.7	47.3	11,885	1,350	3,824	1,192	696	376.3	45.2	157.2	48.9
N. La. and Ark.	108	57.8	5.1	22.3	4.7	6,021	749	1,955	126	103	48.3	4.0	23.5	6.7
Rocky Mountain:														
New Mexico	23	13.3	0.4	4.3	2.3	885	38	183	60	17	10.8	.....	3.4	2.4
Other Rky. Mt.	253	132.4	1.4	61.6	33.4	6,758	229	2,182	960	244	112.6	2.5	52.9	31.5
West Coast ..	1,123	579.6	40.7	171.9	277.7	32,285	1,867	11,281	13,127	1,119	507.4	4.3	187.5	268.4
May 27, 1960	7,899	4,093.4	332.0	1,757.9	900.6	211,653	24,421	91,453	39,997	7,896	3,960.8	244.5	1,751.6	899.2
May 20, 1960	7,935	3,894.6	316.9	1,728.1	884.0	214,128	22,922	87,972	38,875	.....	.....	.....	.....	.....
May 29, 1959	7,888	4,071.6	242.9	1,767.4	951.9	203,140	24,030	97,544	54,669	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	$4.70
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.07
Buckeye Grade	4.07
Illinois Basin	**3.00**

Foreign

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.90
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-NY, dirty (ATRS −35.0%)	$1.79
★ PG-Cal., dirty (USMC −80.0%)	3.26
PG-UK, dirty (Scale −67.5%) (21s. 10d.)	3.05
Carib.-NY, dirty (ATRS −57.5%)	1.17

★ Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):	
★ Regular (91 octane)	11.00
★ Premium (99 octane)	13.50-13.75
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
★ Regular (90 octane)	10.25-10.50
★ Regular (92 octane)	10.50-10.75
★ Premium (98 octane)	11.25-11.75
California (rack) Los Angeles):	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.00
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):	
★ Kerosine 42-44	8.875-9.125
★ Diesel oil (58 d.i. and above)	8.50 -9.00
★ Distillate No. 1	8.50 -9.00
★ Distillate No. 2	7.50 -7.75
Gulf Coast (cargoes):	
Kerosine 41-43	8.875-9.00
Distillate No. 2	7.875-8.00
New York Harbor (barges):	
Kerosine 41-43	9.8-10.3
Distillate No. 2	8.8- 9.3
Diesel fuel, 48-52 d.i.	9.1- 9.6
Caribbean area (cargoes):	
Distillate No. 2	8.00

Residual Fuel (Bbl.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.70-1.80
Gulf Coast (cargoes):	
Bunker C fuel	2.10-2.25
New York Harbor (barges):	
Bunker C fuel	$2.47
Caribbean (cargoes):	
Bunker C	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15

★ Denotes change from previous week.

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FOR SALE EQUIPMENT

LPG STORAGE tank. 450 psig. W. P. Good condition, Weight 40,000 lbs. Contact UNITED CARBON COMPANY, Box 235, Satanta, Kansas. Phone OL 7-2210 at Ryus, Kansas.

5—VT-12-I CUMMINS DIESEL ENGINES

Used less than 250 hours. 600 H.P. @2100 RPM. Equipped with #O-SAE flywheel housing; 2—#T-590 turbocharges; 2—15" oil bath air cleaners; 2—Perry water filters; Penn. safety controls, mechanical variable 3-speed governor. Includes industrial radiator with fan drive, and with or without Cotta 6-speed transmission. Price with transmission $11,000.00 each, FOB Long Beach, California or Breckenridge, Texas.

For information call or write:

W. E. RAFFETY
BJ SERVICE, INC.
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LIQUIDATION

AMOCO REF. DESTREHAN, LA.

BOILERS, 70,000 #/hr. & 80,000 #/hr. 450 Psi.
HORTONSPHERES, 5,000 & 10,000 bbl.
EXCHANGERS, 78 to 2,800 sq. ft.
TOWERS, 3 ft. to 7½ ft. diameter.
VESSELS, 2 ft. to 10 ft. diameter.
FURNACES, 26 MM BTU/hr.
TURBO EXHAUSTERS, 15,360 & 17,000 CFM.
CENT. PUMPS, 15 to 7,000 GPM.
TURBINES, 5 to 290 HP.
TANKS, 1,000 to 29,000 bbl.
COMPRESSORS, (IR) XVG—4 & XVG—2.

BRILL EQUIPMENT COMPANY
DESTREHAN, LA.
TEL. NORCO 6571
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NO. 45 STAR Spudder on rubber. 145 H. P. Hercules motor (good) Tools 15 in. down, ready to drill. Inventory on request. Elk Drilling Co. Inc., Howard, Kans.

SOHIO PETROLEUM COMPANY

Patoka Water flood properties located near Patoka, Illinois. Properties include 18 water flood units and leases.

Additional information may be obtained by writing:
Box 416
or calling
2-4701 Centralia, Illinois
Attn: C. A. Keller

—PIPE—

2,000,000 ft.	2"	3.50# to the ft.
1,000,000 ft.	3"	7.70#
1,000,000 ft.	4"	10.98#
500,000 ft.	6"	19.80#
200,000 ft.	8 5/6"	28#
400,000 ft.	10¾"	35#
75,000 ft.	12¾"	40#
10,000 ft.	16"	42#

All No. I Grade plain end and cleaned.

INDIANA-OHIO PIPE CO.
P. O. Box 5412 Shep. Sta.
Columbus 19, Ohio
Phone CL 3-5537

NEW CROLOY 5 HEATER TUBES

Priced at ½ New Cost

Must Move at Once

14—3¾"	x ⅜" wall x 44' long
63—4"	x ⅜" wall x 26' long
10—4"	x ⅜" wall x 32' long
50—4"	x ½" wall x 32' long
3—5"	x ½" wall x 42' long
42—6"	x ½" wall x 27' to 47' long

HEAT & POWER CO., INC.
60 E. 42nd St., N. Y. 17, N. Y.
310 Thompson Bldg., Tulsa 3, Okla.

100,000 FT. CASING AND TUBING

BY AUCTION

Thursday, June 9, 1960 at 10:00 A. M.

JAMISON PIPE & TOOL CO.
Madison, Kansas

All sizes of casing from 2-in. to 13⅜-in., A.P.I.
15 pumping units—various sizes.
100,000 ft. of rod.

FOR SALE EQUIPMENT

3-CLARK GAS COMPRESSORS
500 H. P., Model RA-5
14" x 14", 300 RPM With
17" x 14" VTH Cylinders
COMPLETE-EXCELLENT CONDITION
HEAT & POWER CO., INC.
60 E. 42nd St., N. Y. 17, N. Y.
310 Thompson Bldg., Tulsa 3, Okla.

LIQUIDATION

at ESSO REFINERY Balto., Md.

10,000 BBL/DAY FLUID COKER
COMPLETE—NEW 1955
STILL ON FOUNDATIONS

TOWERS

10' x 145'—125 PSI	50 trays
9'6" x 121'—325 PSI	30 trays
8'6" x 103'—165 PSI	24 trays
7'0" x 82'— 75 PSI	30 trays
6'0" x 80'—300 PSI	30 trays
4'9" x 44'—150 PSI	12 trays
3'6" x 36'—400 PSI	12 trays
2'6" x 52'—360 PSI	22 trays
2'2" x 57'— 85 PSI	4 trays

HEAT EXCHANGERS—CONDENSERS

Steel Tube	7,500 to 100 sq. ft.
Adm. Tube	3,500 to 236 sq. ft.
Cu Ni Tube	2,330 to 308 sq. ft.
S. S. Tube	1,000 to 170 sq. ft.

CLARK COMPRESSORS
RA5 GAS ENGINE 2VTH 17" x 14" CYL

BLOWERS—28,000 CFM @ 17 PSIG
11,880 CFM @ 11 PSIG
INSTRUMENTS—Controllers, Recorders, Indicating and Transmitting
MOTORS—10 HP to 500 HP XP
PIPE CHROME—3¼" to 14" OD
PUMPS—Hot Oil, Steam, Centrifugal
REACTOR—8' x 32'6" OA
REBOILERS—2,700 to 450 sq. ft.
TRANSFORMERS—5 KVA to 333 KVA
VALVES—Diaphragm, Butterfly Slide and Pressure Regulating
VESSELS PRESSURE—3' to 12' Dia.

PETRO CHEM FURNACE
1.9 MILLION BTU NEW 1949

WRITE FOR COMPLETE CATALOG

HEAT & POWER CO. INC.
60 East 42nd St., New York 17, N.Y.
310 Thompson Bldg., Tulsa 3, Okla.
Box 5203, Baltimore 24, Maryland

FOR SALE EQUIPMENT

18" AND 20" good used pipe. Very attractive prices. Contact: The Tri-State Pipe Co., Bellaire, Ohio. Telephone OR 6-1452.

WELL DRILLS—CORE DRILLS. Everything for well and core drilling in both new and used equipment at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

2—HALL SCOTT "Defender" 2269 V-12 with Marine Reverse Gear Box and Clutch Bore 5¾" stroke 7 Cu. In. Displacement 2181 Compression Ratio 7:00-1 at $1,500. Each. Original cost to government $18,000. These motors are like new. Phone FR 9-5131, Seguin, Texas. Write Texas Acidizers, P. O. Box 47, Seguin, Texas.

8,350 ft. 2⅞" EUE seamless 8R thread, used tubing: 60 cents per ft. 3,000 ft. 2⅞" ditto, 10 thread: 55 cents per ft. Located Elk City, Okla. 1,200 ft. 4" O.D. full hole drill pipe: Located Blackwell, Okla. Carman Supply Co., Phone RIverside 2-3502, 1008 E. 36th St., Tulsa.

1—36L BUCYRUS-ERIE drilling machine, 1950 model, skid mounted, with 1956 140 GK Waukesha engine; casing strut, derrick crane casing line. A-1 condition at an exceptionally low price. Located in our yard. Degen Pipe and Supply Co., Tulsa, Oklahoma.

100,000 FT. OF CASING and Tubing. By Auction. Thursday, June 9, 1060 at 10 A.M. Jamison Pipe & Tool Co., Madison, Kansas. All sizes of tubing and casing from 2" to 13⅜", API. 15 pumping units 100,000 ft. of rods.

FOR SALE

The following used equipment located near Bowie, Texas:

32,000 ft. 5½" O.D.; 15.50 lb.; range 2; J—55; smls. steel casing
28,000 ft. 2⅜" O.D.; 4.70 lb.; range 2; J—55; EUE tubing
17,000 ft. ¾" sucker rods
12,000 ft. ⅞" sucker rods
1—Ideco type S221 pumping unit w/ZC739 Fairbanks & Morse engine
1—United Supply Co. type 302 pumping unit w/Continental C-96 engine
1—Parkersburg type 64 HGS pumping unit w/ZC739 Fairbanks & Morse engine
1—American T-17 pumping unit
1—BS&B 6' x 20' heater-treator
1—Hanlon-Waters 3' x 12' oil and gas separator
4—210 Bbl. steel welded tanks w/rigging & connections
1—150 Bbl. steel welded tank

P. O. Box 2904, Dallas, Texas
Phone RIverside 7-3766

HELP WANTED

DRILLING MUD Engineer with B.S. in engineering, chemistry or geology. Write giving resume of experience, education and salary expected. Adee Engineering Service, P. O. Box 543, Lovington, New Mexico.

SALES ENGINEER with Station Manager experience. Must be skilled in acidizing, fracturing, cementing and oil field services. Salary comensurate with capacity to produce. Contact Allied Services, Inc., Clark Core, P. O. Box 47, Seguin, Texas. Phone FR 9-5132.

SUPERVISOR FOR REFINERY BLENDING SCHEDULING AND PLANNING SECTION

Immediate opening exists with a Caribbean Oil Refinery for a position entailing product blending, shipment scheduling, and refinery operations planning. This position requires a man with approximately five years experience in practical blending, shipment scheduling, and operations planning, as well as the ability to use mathematical techniques to improve existing blending methods.

Apply, Box L-867
The Oil and Gas Journal
Tulsa, Oklahoma

HELP WANTED

SALES ENGINEER needed, for work with oil and gas industries in Rocky Mountain area with possible Denver location. Experience in control equipment desirable. Some travel required. Excellent growth opportunities. Salary open. Send photograph and complete resume so interview may be arranged. Box L-853, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY INSTRUMENT Engineer with experience on varied type instruments. Give resume of experience, education and salary expected. Box L-843, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW OIL JOB Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, butane and pipeline companies. Nationwide, $5.00 cash. OIML Co., Box 2603, Tulsa, Oklahoma.

TRANSLATORS, Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian. Send resume to: A•T•S, Inc., Drawer 271, East Orange, N.J.

SITUATIONS WANTED

PETROLEUM ENGINEER (BS)—25 single. Desirous of changing position. Locate anywhere. Resume upon request. Box L-852, The Oil and Gas Journal, Tulsa, Oklahoma.

PROFESSIONAL ENGINEER—11 years experience design and development oil and gas production equipment and gasoline plants desires research and development position. P. O. Box 7423, Dallas 9, Texas.

PETROLEUM Engineer—Five years diversified field experience in reservoir and production engineering. Married. Available May 31. Box L-856, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-ENGINEER—Excellent experience in exploration, drilling and completion. Independent past three years. Gone busted. Seeking retainer or contract work. Guarantee satisfaction or no pay. Box L-853, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER AND PRODUCTION superintendent experienced in all phases of production and qualified as expert in secondary recovery. 14-years' experience in Mid-Continent, Box L-851, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM—Corrosion Engineer, B.S. 1952, experience in cathodic protection and oil field operations. Desire position with growth potential. Will relocate. Age 35, married. Box L-854, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER. 19 years experience in petroleum engineering and multifunctional planning work, last 7 years in supervisory managerial posts, desires responsible position petroleum or petrochemical company. Write: Box L-863, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, '48 graduate, experienced all phases petroleum exploration including surface, subsurface, geophysical coordination and planning in Canada, U.S., South America. Background includes successful exploration supervision. Desires foreign position. Box L-855, The Oil and Gas Journal, Tulsa, Oklahoma.

THINKING of starting a reservoir engineering section? Reservoir and production engineer, age 37, presently working as reservoir engineer in major oil company headquarters office desires job with smaller company or independent. Salary requirement $825. Box L-864, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS SERVICE

DELAWARE CORPORATIONS formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

MONEY RAISING

NEED CAPITAL to drill 160 acres, direct offset to new Bartlesville Sand well. Primary production 775-ft. deep. Reply P. O. Box 8, Cherryvale, Kansas.

EQUIPMENT WANTED

USED PRI MODEL 111-C portable scintillator crystal dia. 2¼" wt. 8½ lbs. or other similar. P. O. Box 5315, Tulsa, Okla. Tel. RI 2-8271.

WANTED—1,000 feet 2" or 2⅛" drill pipe in 10' 15' or 20' length or 40' tool joints. Describe. A P., 2017 West 47 Street, Chicago, Illinois.

BUSINESS OPPORTUNITIES

IF YOU HAVE substantial development necessary or desirable and present oil and financing conditions make it difficult, have considerable pipe available. Can furnish on deferred secured payment. Must have some equity production to back up for safety, as not interested in speculative development, but can carry on deferred basis, if secure. Box L-857, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILL YOUR OWN WELLS: Will rent on rental-purchase basis, or sell, complete Rotary Rig in good condition, equipped to drill to 7,500'. Located in North Texas. Would take stocks or bonds in on sale. Box L-848, The Oil and Gas Journal, Tulsa, Oklahoma.

FINANCIAL Contacts, Underwriters, Private Brokers reached. No shopping. Confidential. Send details to Consultant—817—81st Street, Brooklyn, N. Y.

NEW PRODUCTS WANTED—Well-established, responsible company with complete facilities for developing, manufacturing and marketing oil field equipment is seeking new or improved products, preferably patented or patentable to add to its presently well-known line. Royalty basis or outright purchase. Initial submission should identify product and general use without revealing engineering and confidential detail. Submissions will be handled promptly and confidentially. Box K-994, The Oil and Gas Journal, Tulsa, Oklahoma.

NOTICE FOR PROPOSAL OF NATURAL GAS FRANCHISE

Proposals for an exclusive natural gas franchise will be accepted in the office of the City Clerk of the City of Wilton Manors, Florida, 524 N. E. 21st Court, Wilton Manors, Fort Lauderdale, Florida, until 8:00 o'clock P. M. on Tuesday, July 12, 1960.

OIL LEASES $120, 40 ACRES LOW AS $30 DOWN $10 A MONTH

Major company makes first Devonian discovery in Utah. 575 barrels of oil per day. Also large production from Pennsylvanian and Mississippi formations. Send for free maps and information, an our system, of hedging on oil and gas leases. Send now:

ATLAS OIL SURVEY
Dept. OGJ-6
Colorado Building, Denver 2, Colorado.

ROYALTIES

HIGHEST PRICE paid for income royalties, overrides, oil properties. A. S. Berry, 109 Midco Bldg., 302 South Cheyenne, Tulsa, Oklahoma.

NOTICE INVESTORS, income producing oil, gas-distillate royalties for sale. Ogden Oil Company. P. O. Box 490, Taylor, Texas.

COMPLETION RECORDS

MY SET OF Illinois, Indiana, Kentucky completion cards complete from beginning of scout check through January 1st, 1960 on 16 millimeter microfilm, over 95,000 cards. P. O. Box 1531, Denver, Colorado.

PRODUCTION WANTED

WANTED: Producing lease that can be operated on farmout basis, 30 bbls. or more oil. Box L-861, The Oil and Gas Journal, Tulsa, Oklahoma.

PURCHASE OIL & GAS PROPERTIES

Principal wishes to purchase developed reserves. Location no factor. Confidential and expeditious consideration of any property between $50,000 and $5,000,000. Brokers protected.

Write or call our agent:

R. A. MASON, Petr. Engr.
2212 First National Bldg.
Oklahoma City, Oklahoma
Phone: CEntral 5-4468

MANUSCRIPTS

HAVE YOU WRITTEN A BOOK?

If you have a book manuscript or outline for a book on an oil industry engineering, operating or technical subject—we are in a position to help you get it published. Write briefly outlining what you have!

Write to—**L. B. Lofton**
THE OIL AND GAS JOURNAL
P. O. Box 1260—Tulsa 1, Okla.

LEASE AND DRILLING BLOCKS

SEVEN wells Louisiana: 1,500' Wilcox sand, 113 acres, 20 proven locations. $35,000. C. R. Harwood, 500 Grant Street, Denver, Colorado. Phone Spruce 7-4493.

FARMOUTS—2,000A, Caney Pool, Pickett Co.; Tenn.; 300A, Gilmer Co., W.Va.; 250A, Wayne Co., Ohio; 6,000A-North Salem Oriskany Pool, Guernsey Co., Ohio-96 World Oil March. Box 215, Lodi, Ohio. Ph. 3881-5141.

Have several Drilling Blocks in Vinton, Jackson, Gallia, Lawrence, Hocking County, Ohio, also West Virginia acreage to farm out. Capital needed to drill, offset production.

DAVID LAW
717 Union Trust Building
Parkersburg, West Virginia
Phone HU 5-6446

—WANTED—
OIL AND GAS RESERVES

By diversified public corporation listed on American and Toronto Stock Exchanges. Wish to purchase either fully developed producing properties or partially developed properties with proven locations. Also interested in acquisition of small producing companies by merger. Submit complete information to:

Dr. Robert V. West, Jr.

2000 National Bank of Commerce Bldg.
San Antonio 5, Texas.

THE TEXSTAR CORPORATION

NOTICE OF PROPOSED SALE OF OIL AND GAS LEASES AND OTHER PROPERTIES BY TEXAS CONSOLIDATED OILS

This is to give notice that Texas Consolidated Oils, 35th Floor Southland Center, Dallas 1, Texas, desires to sell all of its producing and non-producing oil and gas leases in Texas, Oklahoma, New Mexico, Louisiana, Kansas and California; and other related property. Anyone interested in making a sealed bid for the purchase of these properties may obtain bidding forms and a statement of the terms and conditions relating thereto, with a schedule of property being offered for sale attached, by writing the Company at the above address. A packet containing individual lease plats, production data, and other general information will be available to prospective bidders upon deposit or One Thousand Dollars ($1,000.00). Such deposit will be returned by the Company to any party making a bid on these properties or upon return of the packet of data forty-eight (48) hours or more in advance of 10:00 A.M. Central Standard Time on July 15, 1960. Bids for the properties will be considered only if made in accordance with and subject to the terms and conditions set forth in such statement. All bids must be presented to or received by:

The Trust Department
Republic National Bank of Dallas, Texas
before 10:00 A.M., Central Standard Time
on July 15, 1960

LEASE AND DRILLING BLOCKS

MINERAL INTERESTS Webster, Bossier Parishes, La., Liberty, Harris, Cherokee, Delta Counties, Tex., Miller County, Ark. Mason, 103 Ardmore, Shreveport, La.

160 ACRE FARMOUT to drill 2,500 ft. Good Geology. Several producing sands. Osage County. Box L-866, The Oil and Gas Journal, Tulsa, Oklahoma.

3,500 ACRES $2 per acre. Lawrence County, Ky. m midst of new gas play. Ten year leases in first year, 1/8 override, no drilling committment, 50 cents per acre annual rental. U. S. Andersen, 8350 Santa Monica Blvd., LA 46.

MONTGOMERY COUNTY, Mississippi on top of the Kilmichael Dome offers 4 likely oil sands at less than 3,500 feet. Surface, magnetomer and seismograph confirms 31-19-7 drill site between Highway 82 and C&G RR. Will block leases at $1.50 an acre on HIGHS. Gusher, 1369 Court, Memphis 4, Tenn.

PROSPECTIVE OIL Land: Suitable townsite acreage in fee, E/35 acres, Sec. 16, Block JKL, PSL Survey, Hudspeth County, Texas, at intersection U. S. Highway 62 and F. M. 1437 Highway, south of Dell City, Texas. Write quickly, Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

FOUR 320 Acres Oil and Gas Leases. Pecos County, Texas, starting first 5,500 foot Delaware test this week. $2,100.00 per 1/8th covers all cost to casing point. 1/8th of $3.00 per foot dry hole money returned if well is dry. 1/16ths open. All funds escrowed. Discovery allowable 94 bbls. per day. 30 days per month. Quick payout. Turnkey Drillers, Box 1492, Midland, Texas.

LEGAL

SALE OF OIL AND GAS MINING LEASES TRIBAL INDIAN LANDS SALE No. 10. Department of the Interior, Bureau of Indian Affairs, Crow Indian Agency, Crow Agency, Montana. An oral auction will commence at 2:00 o'clock P.M., Mountain Standard Time, June 13, 1960, at the Office of the Crow Indian Agency, Crow Agency, Montana, for the leasing of 5 units of unsurveyed tribal lands comprising approximately 3,200 acres more or less in T. 8 S., R. 25 E., Big Horn County, Montana, for oil and gas mining purposes. The details of the lease offering and information may be obtained by addressing the inquiry to the Superintendent of Crow Indian Agency, Crow Agency, Montana.

LEGAL

SALE OF OIL AND GAS MINING LEASES TRIBAL AND ALLOTTED INDIAN LANDS SALE NO. 11, Department of the Interior, Bureau of Indian Affairs, Crow Indian Agency, Crow Agency, Montana. Sealed bids will received until June 13, 1960, 2:00 o'clock, P.M., Mountain Standard Time, and opened at that time in the office of the Crow Indian Agency, Crow Agency, Montana, for the leasing of 15,559.94 acres of tribal land located in T. 5 S., R. 26 E., T. 5 S., R. 27 E., T. 6 S., R. 26 E., T. 5 S., R. 25 E., and 20,007.43 acres of allotted land located in T. 5 S., R. 26 E., T. 6 S., R. 26 E., T. 5 S., R. 25 E., Big Horn County, Montana, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of Crow Indian Agency, at Crow Agency, Montana.

LEGAL

NOTICE OF SALE OF OIL, GAS, AND SULPHUR LEASE. Pursuant to the provisions of Chapter 150 of the General and Special Laws of the State of Texas, passed by the 45th Legislature at its Regular Session, as amended by Senate Bill No. 248, passed by the 53rd Legislature at its Regular Session, the Board of Directors of the Agricultural and Mechanical College of Texas hereby offers for sale at public auction in the Office of the Comptroller, Room 202, System Administration Building, College Station, Texas, at 10:00 a. m. Thursday, June 23, 1960, the oil, gas, and sulphur lease on 320 acres in the Northwest corner of the John T. Lewis Survey, Abstract 264, in Newton County, Texas, said land being under the exclusive control of the Board of Directors of the Agricultural and Mechanical College of Texas, and occupied by the Texas Forest Service. The right is reserved to reject any and all bids. For lease forms and particulars, address COMPTROLLER, Texas Agricultural and Mechanical College System, College Station, Texas.

(Continued from page 184)

MONTANA

Rosebud County:
Sinclair Oil & Gas Co. 1 B. E. Kesterson, C SE NW 34-10n-33e. IPF 240 BOPD, 3/32-in. choke, 35°, Amsden 4,815-26 ft. TD 5,240 ft. Amsden discovery, new field.

NEW MEXICO

Chaves County:
Robinson Brothers, Oil Producers 1 Manry Elliott, 7 miles southwest of Caprock in 22-11s-31e. IPCAOF 10 M.M.c.f.d., 50 bbl. condensate per million, Morrow 10,867-10,900 ft. TD 11,066 ft. PBTD 10,963 ft. New gas discovery.

Eddy County:
Chamvers & Kennedy 1 Monterey-State, OWWO, 10 miles southwest of Maljamar in 32-18s-31e. IPP 47 BOPD, Yates sand 2,582-90 ft. TD 3,550 ft. PBTD 2,880 ft. New oil discovery.
Gulf Oil Corp. 1-AD Estill, 15 miles west of Malaga in 29-24s-26e. IPCAOF 46,857 M.c.f.d., 4.2 bbl. condensate per million, Penn. 9,806-16 ft. TD 12,212 ft. PBTD 11,682 ft. New gas discovery.

Lea County:
Pan American Petroleum Corp. 1 West Tonto Deep Unit-Federal, 13 miles south of Maljamar in 18-19s-33e. IPCAOF 2,030 M.c.f.d., 31 bbl. condensate in 21 hours through ¾-in. choke and 4 bbl. water, 52°, TP 640 psi. Morrow 13,325-13,378 ft. TD 14,945 ft. New gas discovery.

Rio Arriba County:
Intex Oil Co. 1 USL-Bajo, C SE NW 9-26n-1e. IPP 28 BOPD, Sanastee 2,345-50 ft. TD 2,357 ft. Sanastee discovery, new field.
El Paso Natural Gas Co. 136 Rincon Unit, NE NE 23-27n-7w. IPF 5,251 M.c.f.d., ¾-in. choke, SITP 2,330 psi.. SICP 2,336 psi. Dakota 7,414-7,644 ft. TD 7,701 ft. Dakota discovery, new pool.

San Juan County:
Pubco Petroleum Co. 9 Pubco-Federal "N," SE SW 9-29n-12w. IPF 3,373 M.c.f.d., ¾-in. choke, Dakota 6,305-62 ft. TD 6,526 ft. Dakota discovery, new pool.

NORTH DAKOTA

Burke County:
I. J. Wilhite 1 J. Pixley, SE SE 23-160n-93w. IPP 40 BOPD, plus 50% water, 39°, Madison discovery, new field. TD 7,687 ft.

OKLAHOMA

Beaver County:
Petroleum Inc. 1 Koch Unit, C NW SE 28-1n-25eCM. IPF 915 BOPD, Tonkawa 6,104-08 ft. 6,122-26 ft.; Morrow 8,122-36, 8,141-7 ft. TD 8,726 ft. New oil discovery.

Carter County:
Kingery Producing Co. 1 Guy Wood, NE SE NW 27-2s-2w. IP 161 BOPD, 1.8% salt water, 25°, Hoxbar 1,734-37 ft. TD 4,500 ft. New pay discovery
Frankfort Oil Co. 1 McKinstry, SE SE NW 6-5s-3w. IP 65 BOPD, 39°, Bois D'Arc 8,601-90 ft. TD 8,690 ft. New oil discovery.

Cleveland County:
Anderson-Prichard Oil Corp. 1 Burkett, NE NW SW 11-7n-2w. IP 14 BOPD, 6 BWPD, 38°, Viola 7,525-43 ft. TD 8,820 ft. New oil discovery.

Ellis County:
Sinclair 1 Stacy A. Woods Unit, SW SW NE 11-23n-26w. IPF 1,635 M.c.f.d.,

Morrow 8,432-8,522 ft. TD 8,795 ft. New gas discovery.

Harper County:

Statex Petroleum Co. 1 E. Bennett, C NW SE 29-27n-21w. IPF M.M.c.f.d., Hunton 7,144-52, 7,174-82, 7,194-7,204, 7,233-45 ft. TD 7,305 ft. New field.

Kingfisher County:

Apache Oil Corp. 1 Snow Unit, SE NW 5-15n-7w. IPF 4,700 M.c.f.d., Manning sand 7,814-57 ft. TD 8,070 ft. New discovery.

Major County:

Livingston Oil Co. 1 Stricklin-Eck, C SE NW 24-22n-11w. IP 485 M.c.f.d., Manning 6,771-6,828 ft. TD 7,161 ft. New gas discovery.

Okfuskee County:

Ambassador Oil Corp. 1 Roman Fixico, SE SW SE 32-12n-9e. IP 158 BOPD, 34°, Gilcrease 3,366-68, 3,378-85 ft. TD 3,566 ft. New oil discovery.

Okmulgee County:

Webco Drilling Co. 1 Williams-Huey, C NE NE 26-11n-12e. IP 4,086 M.c.f.d., Jefferson 3,237-40 ft. TD 3,325 ft. New gas discovery.

Webco 1 Marler-Dudley, NW NW NE 9-11n-13e. IPF 1,250 M.c.f.d., Jefferson 2,693-96 ft. TD 3,765 ft. New gas discovery.

Texas County:

Republic Natural Gas Co. 1 Nordberg Trustee "M", C SW NE 27-6n-15eCM. IPF 6,340 M.c.f.d., 59°, Morrow 6,568-78 ft. TD 7,012 ft. New gas discovery.

TEXAS

Nolan County:

South Byers field. George H. Echols 1 Zelda Hendrick, 1 mile south of Byers field. Sec. 158, ETRR Sur. IPF 91 BOPD, 42°, upper Gardner sand 3,749-55 ft. TD 4,070 ft. New oil discovery.

SOUTH TEXAS

Duval County:

Bridwell area. Camp Oil Co. et al. 1 P. G. Rogers, 10 miles northwest of San Diego in Sec. 9, E. Navarro Sur. A-737. IP Shut in gas discovery. Hockley 3,574-77 and 3,582-83 ft. TD 4,410 ft. New gas discovery.

Zapata County:

Northeast Lopena area. Crescent Oil & Gas Corp. 1 Serapio Vela, 8 miles southeast Zapata in El Grullo Grant, A-37. C. M. Doty Subd. IPF 3,800 M.c.f.d. Wilcox 11,052-11,208 ft. TD 11,315 ft. New gas discovery.

SOUTHWEST TEXAS

Refugio County:

Bonnie View. Harkins & Co. 1 C. F. Crow, 4 miles southeast of Woodsboro in Esteban Lopez Sur., A-44. IPAOF 3,700 M.c.f.d., 60°, GLR 20,000:1, Frio 8,139-44 ft. TD 8,146 ft. New gas-condensate discovery.

Victoria County:

E. Telferner Bankhead sand discovery. Catahoula Oil & Gas Co. 1 Owen Kolle, Thos. G. Burnham Sur., A-132. IPF 52 BOPD, 5,080-ft. Frio 5,090-93 ft. TD 6,150 ft. New oil discovery.

WYOMING

Campbell County:

Hondo Oil & Gas Co. 1 Federal, C SE NE 13-50n-69w. IPP 100 BOPD, cut 6% water, 19°, Minnelusa 7,902-42 ft. TD 8,088 ft. Minnelusa discovery, new field.

Sweetwater County:

Arch Unit. Forest Oil Corp.-UPRR 19-1 Arch 2, C SE SW 19-19n-98w. IPF 607 BOPD, ½-in. choke, Almond 5,066-90 ft. TD 5,564 ft. Almond discovery, new field.

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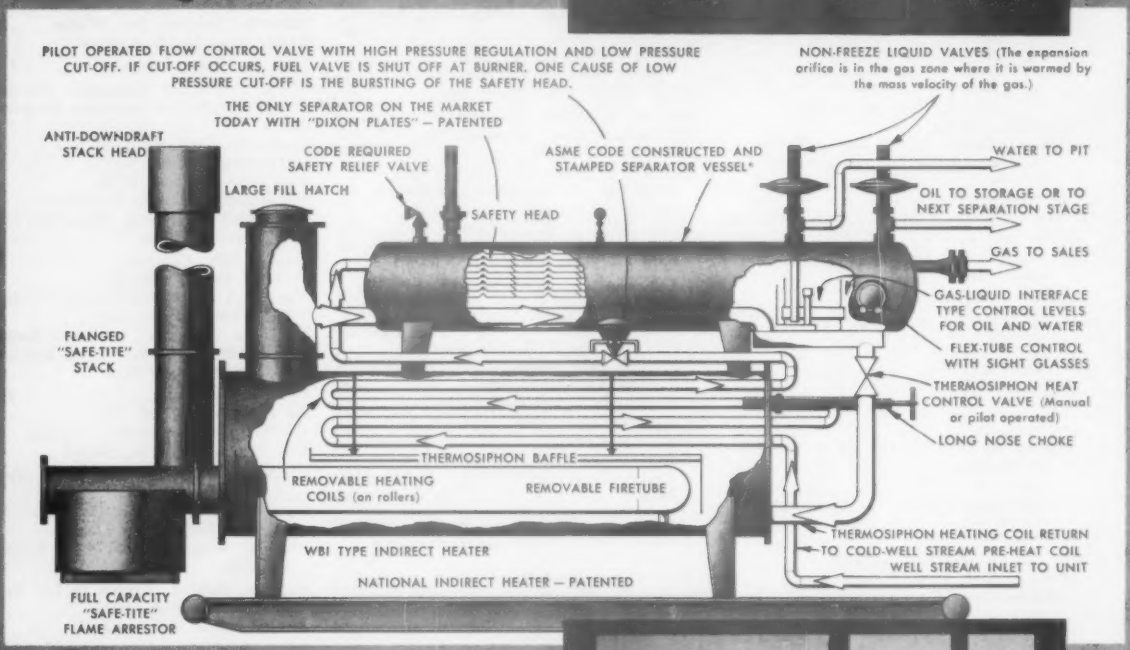
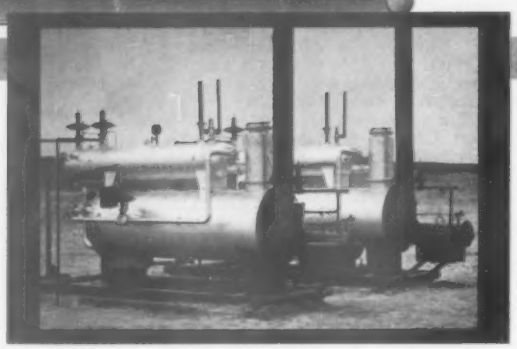

PILOT OPERATED FLOW CONTROL VALVE WITH HIGH PRESSURE REGULATION AND LOW PRESSURE CUT-OFF. IF CUT-OFF OCCURS, FUEL VALVE IS SHUT OFF AT BURNER. ONE CAUSE OF LOW PRESSURE CUT-OFF IS THE BURSTING OF THE SAFETY HEAD.
NON-FREEZE LIQUID VALVES (The expansion orifice is in the gas zone where it is warmed by the mass velocity of the gas.)
THE ONLY SEPARATOR ON THE MARKET TODAY WITH "DIXON PLATES" — PATENTED
ANTI-DOWNDRAFT STACK HEAD
CODE REQUIRED SAFETY RELIEF VALVE
ASME CODE CONSTRUCTED AND STAMPED SEPARATOR VESSEL*
WATER TO PIT
LARGE FILL HATCH
SAFETY HEAD
OIL TO STORAGE OR TO NEXT SEPARATION STAGE
GAS TO SALES
GAS-LIQUID INTERFACE TYPE CONTROL LEVELS FOR OIL AND WATER
FLANGED "SAFE-TITE" STACK
FLEX-TUBE CONTROL WITH SIGHT GLASSES
THERMOSIPHON HEAT CONTROL VALVE (Manual or pilot operated)
LONG NOSE CHOKE
THERMOSIPHON BAFFLE
REMOVABLE HEATING COILS (on rollers)
REMOVABLE FIRETUBE
THERMOSIPHON HEATING COIL RETURN TO COLD-WELL STREAM PRE-HEAT COIL
WELL STREAM INLET TO UNIT
WBI TYPE INDIRECT HEATER
NATIONAL INDIRECT HEATER — PATENTED
FULL CAPACITY "SAFE-TITE" FLAME ARRESTOR



National Thermosiphon Stak-Paks are composed of standard separator and indirect heater units. They are available in combinations of two or three-phase horizontal separators together with any size indirect heater. Completely skid mounted and pre-piped, the ASME code stamped separator is not immersed in the water bath of the heater but is placed above. Glycol protected water bath will not freeze. No housing or insulation needed in moderate climates such as Oklahoma, Kansas and Texas.

The Stak-Pak is available with all controls and valves manufactured by National . . . one supplier — one source . . . non-freeze type liquid valves, FLEX TUBE® liquid level controls, interface level controls, long nose chokes and many others PLUS National's 'Safe-Tite' Flame Arrestors and safety-drilled return bends in heating coils.

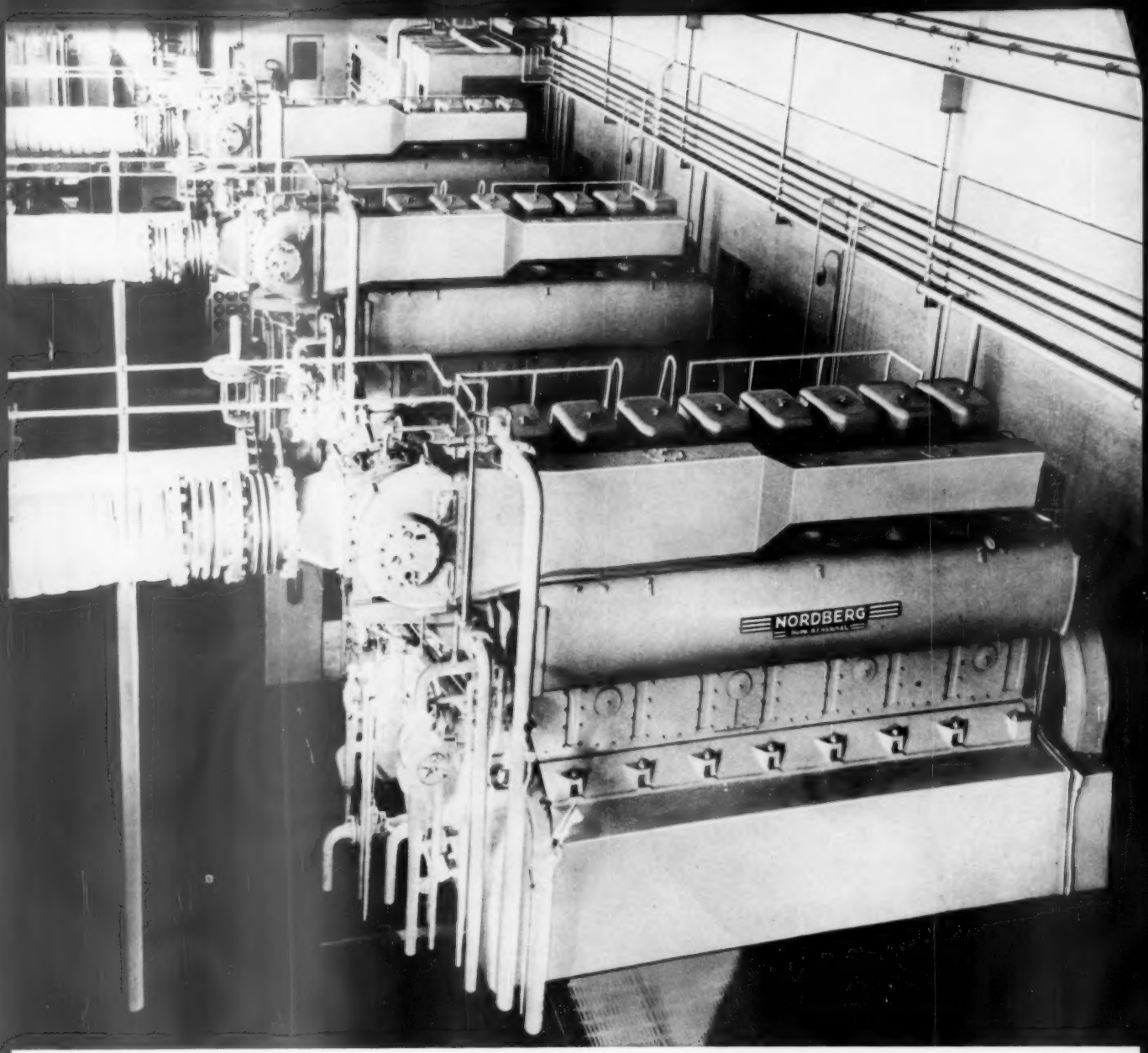
For complete information and colored flow diagram on the all-new National Thermosiphon Stak-Pak, contact your nearest National Tank Company branch or write direct to . . .

It's a National®

NATIONAL TANK COMPANY

DRAWER 1710

TULSA, OKLAHOMA



0758-R

Pipe line engines by Nordberg

Twenty-four Nordberg *Supairthermal*® engines, representing a total of forty-six thousand horsepower, have been installed in pumping stations of the Trans Mountain crude oil pipe line from Edmonton, Alberta, to Vancouver, British Columbia.

NORDBERG MANUFACTURING COMPANY
MILWAUKEE 1, WISCONSIN

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